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A POPULATION OF LINEAR, SECOND ORDER ELLIPTIC PARTIAL DIFFERENT--ETC(U)
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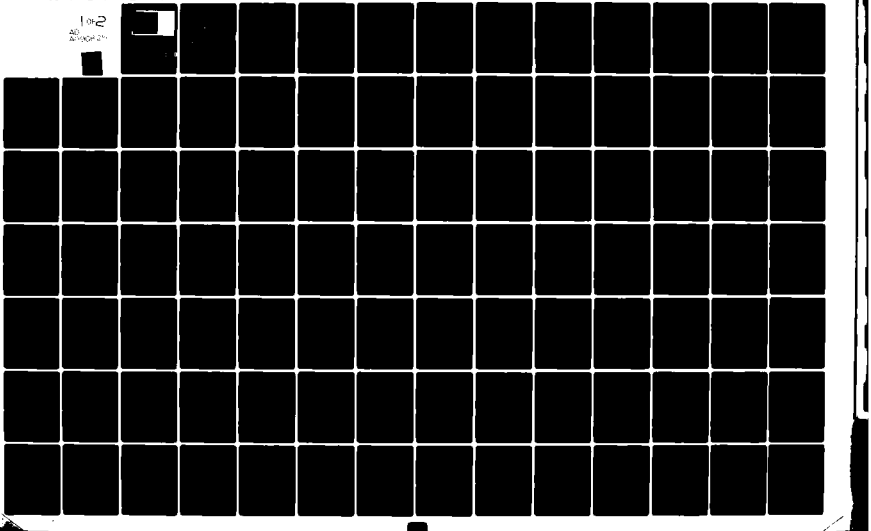
UNCLASSIFIED MRC-TSR-2079 NL



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MRC Technical Summary Report # 2079

A POPULATION OF LINEAR, SECOND ORDER, ELLIPTIC PARTIAL DIFFERENTIAL EQUATIONS ON RECTANGULAR DOMAINS - PART 2

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UNIVERSITY OF WISCONSIN - MADISON
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A POPULATION OF LINEAR, SECOND ORDER ELLIPTIC PARTIAL DIFFERENTIAL EQUATIONS ON RECTANGULAR DOMAINS - PART 2

John R. Rice, Elias N. Houstis and Wayne R. Dyksen

Technical Summary Report # 2079
May 1980

ABSTRACT

This report contains the machine readable form of the 189 partial differential equations presented in MRC Technical Summary Report #2078 "A POPULATION OF LINEAR, SECOND ORDER, ELLIPTIC PARTIAL DIFFERENTIAL EQUATIONS ON RECTANGLES - PART 1." These are two large files: EQNFIL contains 189 entries which are either complete statements of a PDE in the ELLPACK language or a reference to an entry in MACFIL with parameter values given. MACFIL contains the 42 parameterized PDE's in a form suitable for automatically substituting in parameter values. A few other small files are given to facilitate using this problem population within the ELLPACK system.

AMS(MOS) Subject Classification: 65N99

Key Words: elliptic partial differential equations, machine readable, population of problems, linear, second order

Work Unit Number 3 - Numerical Analysis and Computer Science

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SIGNIFICANCE AND EXPLANATION

This is machine readable information associated with MRC Technical Summary Report #2078 provided for people who are actually involved in computing with the population of PDE problems. Many of the 189 problems are very complex and the only reliable way to transmit them accurately is in this form.

The responsibility for the wording and views expressed in this descriptive summary lies with MRC, and not with the authors of this report.

A POPULATION OF LINEAR, SECOND ORDER ELLIPTIC PARTIAL DIFFERENTIAL EQUATIONS ON RECTANGULAR DOMAINS - PART 2

John R. Rice, Elias N. Houstis and Wayne R. Dyksen

1. INTRODUCTION

It is assumed that the reader is familiar with Part 1 of this report, MRC Technical Summary Report #2078. This second part presents the population in machine readable form. There are seven files; the first is a program that takes information from the other files and creates complete ELLPACK program with the PDE problems. The second and third files are quite long and contain the actual descriptions of the PDE problems. The last four files are quite short and have information needed to form complete ELLPACK programs; these are not essential to the populations. Each file has extensive descriptive comments at the beginning.

The file EQNFIL has 189 parts, one for each PDE. Each part corresponding to a problem without parameters is just the ELLPACK statement of the operator, domain and boundary conditions along with associated Fortran functions. Each part corresponding to a parameterized PDE states the values of the parameter; the detailed statement of the PDE is in the third file MACFIL. The entries in MACFIL are ELLPACK statements of the PDE with the points where parameters are to be inserted marked by &A, &B, etc.

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```
      PROGRAM GENPGM (TAPE1,TAPE2,TAPE3,TAPE4,INPUT,OUTPUT,TAPE7,       GENPGM       1
     $                TAPE8,TAPE9,TAPE10,TAPE5=INPUT,TAPE6=OUTPUT)      GENPGM       2
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCGENPGM       3
C                                                                       CGENPGM       4
C                                                                       CCENPGM       5
C                            --------------                             CGENPGM       6
C                            PROGRAM GENPGM                             CGENPGM       7
C                            --------------                             CGENPGM       8
C                                                                       CCENPGM       9
C                                                                       CCENPGM      10
C       AUTHOR:  RONALD F. BOISVERT                                     CGENPGM      11
C                DEPARTMENT OF COMPUTER SCIENCES                        CCENPGM      12
C                PURDUE UNIVERSITY                                      CGENPGM      13
C                AUGUST 4, 1978 (REVISED JANUARY 29, 1979)              CGENPGM      14
C                                                                       CCENPGM      15
C                                                                       CCENPGM      16
C       REVISED: WAYNE R. DYKSEN                                        CCENPGM      17
C                DEPARTMENT OF MATHEMATICS                              CCENPGM      18
C                PURDUE UNIVERSITY                                      CCENPGM      19
C                NOVEMBER 1, 1979                                       CCENPGM      20
C                                                                       CCENPGM      21
C                                                                       CCENPGM      22
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCENPGM      23
C                                                                       CCENPGM      24
C                                                                       CCENPGM      25
C  GENERAL DESCRIPTION:                                                 CCENPGM      26
C  --------------------                                                 CCENPGM      27
C                                                                       CCENPGM      28
C     GENPGM GENERATES AN ELLPACK PROGRAM ACCORDING TO THE SPECIFICA-    CCENPGM      29
C  TIONS GIVEN IN AN ENCODED INPUT STRING.  THE RESULTING ELLPACK       CCENPGM      30
C  PROGRAM IS WRITTEN ON FILE PGMFIL.                                   CCENPGM      31
C                                                                       CCENPGM      32
C                                                                       CCENPGM      33
C  ENCODED ELLPACK PROGRAMS:                                            CCENPGM      34
C  -------------------------                                           CCENPGM      35
C                                                                       CCENPGM      36
C     THE ELLPACK PROGRAM TO BE GENERATED IS ENCODED AS FOLLOWS:        CCENPGM      37
C                                                                       CCENPGM      38
C           N1-N2/N3/N4/N5/N6/N7/N8/COMMENT/                            CCENPGM      39
C                                                                       CCENPGM      40
C     WHERE  N1  IS THE NUMBER OF THE PROBLEM TO BE SOLVED              CCENPGM      41
C            N2  IS THE PARAMETER SET NUMBER (IF ANY)                   CCENPGM      42
C            N3  IS THE OPTIONS SEGMENT NUMBER,                         CCENPGM      43
C            N4  IS EITHER M1 OR M1,M2 OR M1,M2,M3 GIVING EITHER A      CCENPGM      44
C                GRID NUMBER OR THE SIZE OF A 2 OR 3 DIMENSIONAL        CCENPGM      45
C                UNIFORM GRID RESPECTIVELY,                             CCENPGM      46
C            N5  IS EITHER M1 OR M1,PARAMETER LIST, WHERE M1 IS THE     CCENPGM      47
C                MODULE NUMBER OF THE DISCRETIZATION MODULE AND THE     CCENPGM      48
C                PARAMETERS ARE OPTIONAL PARAMETERS WHICH ARE TO BE     CCENPGM      49
C                PASSED TO THE MODULE,                                  CCENPGM      50
C            N6  GIVES THE MODULE NUMBER AND PARAMETERS OF THE          CCENPGM      51
C                INDEXING MODULE AS IN N5,                              CCENPGM      52
C            N7  GIVES THE MODULE NUMBER AND PARAMETERS OF THE          CCENPGM      53
C                SOLUTION MODULE AS IN N5,                              CCENPGM      54
C            N8  IS THE OUTPUT SEGMENT NUMBER.                          CCENPGM      55
C            COMMENT  IS A COMMENT OF .LE. 50 CHARACTERS.  IF THE       CCENPGM      56
C                     FIRST CHARACTER OF THE COMMENT IS $, THEN A       CCENPGM      57
C                     SUMMARY OF THE RUN IS PLACED ON THE FILE HEADER.  CCENPGM      58
C                                                                       CCENPGM      59
C        THE PROBLEM NUMBER IS A FILE NUMBER IN FILE EQNFIL.            CCENPGM      60
C     THE PROBLEM, GRID, OPTIONS AND OUTPUT NUMBERS ARE RECORD          CCENPGM      61
C     NUMBERS IN THE FILES MACFIL, GRDFIL, OPTFIL AND OUTFIL RESPEC-    CCENPGM      62
C     TIVELY. THE PARAMETERS N6 AND N7 MAY BE NULL IF NO INDEXING OR    CCENPGM      63
C     SOLUTION MODULE IS REQUIRED.  THE PARAMETERS N3 AND N8 MAY BE     CCENPGM      64
C     NULL IN WHICH CASE THE FOLLOWING DEFAULT SEGMENTS ARE USED:       CCENPGM      65
C              OPTIONS.   TIME   $  MEMORY     $  LEVEL=0               CCENPGM      66
C              OUTPUT.    MAX-U  $  MAX(30,20)-ERROR                    CCENPGM      67
C                                                                       CCENPGM      68
C                                                                       CCENPGM      69
C  FILES USED BY GENPGM:                                                CCENPGM      70
C  ---------------------                                                CCENPGM      71
C                                                                       CCENPGM      72
C     FORTRAN IO UNIT NUMBERS FOR THE FILES USED BY GENPGM ARE          CCENPGM      73
C  ASSIGNED IN THE BLOCK DATA SUBPROGRAM.  THE PURPOSE AND FORMAT OF    CCENPGM      74
C  THESE ARE AS FOLLOWS:                                                CCENPGM      75
C                                                                       CCENPGM      76
```

```
C     STANDARD INPUT
C     .. ..........
C
C        THE ENCODED ELLPACK PROGRAMS ARE SPECIFIED IN FREE FORMAT.
C     EACH NEW ENCODED PROGRAM MUST BEGIN ON A NEW LINE AND EACH
C     ENCODED PROGRAM MUST CONTAIN SEVEN SLASHES.
C
C     EONFIL
C     ......
C
C        EONFIL CONTAINS THE INFORMATION NEEDED TO GENERATE THE EQUATION,
C     BOUNDARY AND FORTRAN SEGMENTS OF THE ELLPACK PROGRAM.
C
C        EONFIL IS DIVIDED UP INTO (SUB) FILES WHICH ARE IN TURN DIVIDED
C     UP INTO RECORDS.  THE FILES ARE NUMBERED 0, 1, 2,...ETC. AND THE
C     RECORDS WITHIN EACH FILE ARE SIMILARLY NUMBERED 0, 1, 2,...ETC.
C     THE END-OF-FILE AND END-OF-RECORD ARE DESIGNATED BY *EOF AND *EOR
C     RESPECTIVELY ('EOF AND 'EOF RESPECTIVELY ON NON-CDC INSTALLATIONS).
C
C        FILE 0 CONTAINS A DESCRIPTION OF THE PURPOSE AND ORGANIZATION OF
C     EONFIL.  FILES 1, 2, 3,... CONTAIN THE INFORMATION NEEDED TO GENER-
C     ATE THE ELLPACK PROGRAM CORRESPONDING TO PROBLEMS 1, 2, 3,...
C     RESPECTIVELY OF THE ELLPACK PDE POPULATION. AS MENTIONED ABOVE, THE
C     FILES ARE DIVIDED INTO RECORDS WHICH HAVE THE FOLLOWING FORMAT:
C
C           RECORD 0 CONTAINS THE ELLPACK PDE POPULATION PROBLEM NUMBER.
C        RECORDS 1, 2,... MAY TAKE ONE OF THE FOLLOWING FORMATS:
C
C        ALTERNATIVE 1:
C        ..............
C
C        LINE 1:  LINE 1 IS EITHER BLANK OR CONTAINS DESCRIPTIVE INFORMA-
C        TION SOME OF WHICH BECOMES A COMMENT IN THE GENERATED ELLPACK
C        PROGRAM.  IF NON-BLANK, LINE 1 CONTAINS THE PARAMETER SET NUMBER
C        IN I3 FORMAT STARTING IN COLUMN 15, FOLLOWED BY THE PARAMETERS
C        OF THE PROBLEM IN FREE FORMAT STARTING IN COLUMN 19.
C
C        LINE 2:  LINE 2 CONTAINS THE COMPLEXITY MEASURES OF VARIOUS
C        PROBLEM FEATURES IN FREE FORMAT STARTING IN COLUMN 11.  THIS
C        INFORMATATION BECOMES A COMMENT IN THE GENERATED ELLPACK PRO-
C        GRAM.
C
C        LINE 3:  LINE 3 CONTAINS THE PROBLEM TYPE INFORMATION STARTING
C        IN COLUMN 11 WHICH IS USED TO TEST THE COMPATIBILITY OF THE PRO-
C        BLEM WITH THE ELLPACK ROUTINES SELECTED IN THE ENCODED PROGRAM
C        (SEE ROUTINE COMPAT).  THIS INFORMATION BECOMES A COMMENT IN THE
C        GENERATED ELLPACK PROGRAM.
C
C        REMAINING LINES:  THE REMAINING LINES OF THE RECORD CONTAIN
C        INFORMATION COPIED INTO THE EQUATION, BOUNDARY AND FORTRAN SEG-
C        MENTS OF THE GENERATED ELLPACK PROGRAM IN THE ABOVE ORDER.
C        THE EQUATION, BOUNDARY AND FORTRAN CARDS ARE MARKED BY A 1, 2
C        OR 3 IN COLUMN 1 RESPECTIVELY.  NOTE THAT FORTRAN CODE SHOULD
C        BEGIN IN COLUMN 7 AS USUAL AND THAT A FORTRAN COMMENT CAN BE
C        WRITTEN BY TYPING A C IN COLUMN 2.  FOR PORTABILITY PURPOSES,
C        THE END-OF-RECORD IS DENOTED BY THE PRESENCE OF A '-' (DASH)
C        IN COLUMN 1.
C
C        ALTERNATIVE 2:
C        ..............
C
C        LINE 1:  LINE 1 CONTAINS THE PARAMETER SET NUMBER IN I3 FORMAT
C        STARTING IN COLUMN 15, FOLLOWED BY THE PARAMETERS OF THE PRO-
C        BLEM IN FREE FORMAT STARTING IN COLUMN 19.
C
C        LINE 2:  LINE 2 CONTAINS THE COMPLEXITY MEASURES OF VARIOUS
C        PROBLEM FEATURES IN FREE FORMAT STARTING IN COLUMN 11.  THIS
C        INFORMATION BECOMES A COMMENT IN THE GENERATED ELLPACK PRO-
C        GRAM.
C
C        LINE 3:  LINE 3 IS OF [illegible] (NN1, N2,...,NK) STARTING
C        IN COLUMN 1.  THIS [illegible]
C        MASFIL) SHOULD BE [illegible] 2,...,NK
C        REPLACING THE [illegible]
C        CONTAIN ANY [illegible]
C        MAY BE NO LONGER THAN [illegible]
```

```
C
C  MACFIL
C  ......
C
C     MACFIL CONTAINS THE INFORMATION NEEDED TO FULFILL THE MACRO
C  CALLS ORIGINATING IN EQNFIL.
C
C     MACFIL IS DIVIDED UP INTO RECORDS WHICH ARE NUMBERED 0, 1, 2,...
C  ETC.  THE END-OF-RECORD IS DESIGNATED BY *EOR (*EOR ON NON-CDC
C  INSTALLATIONS).
C
C     RECORD 0 CONTAINS A DESCRIPTION OF THE PURPOSE AND ORGANIZATION
C  OF MACFIL.  RECORDS 1, 2, 3,... CONTAIN THE INFORMATION NEEDED TO
C  GENERATE THE ELLPACK PROGRAMS CORRESPONDING TO PROBLEMS 1, 2, 3...
C  OF THE ELLPACK PDE POPULATION.  ALTHOUGH SOME OF THE PROBLEMS ARE
C  NOT PARAMETERIZED AND HENCE HAVE NO MACRO CALLS, YET, THERE ARE
C  DUMMY RECORDS FOR THESE PROBLEMS ON MACFIL SO THAT THE PROBLEM AND
C  MACRO NUMBERS MAY BE IN A ONE-TO-ONE CORRESPONDENCE.  RECORDS
C  1, 2, 3... HAVE THE FOLLOWING FORMAT:
C
C     LINES 1-3:  LINES 1 THROUGH 3 CONTAIN THE MACRO NUMBER.
C
C     LINE 4:  LINE 4 CONTAINS THE PROBLEM TYPE INFORMATION STARTING
C     IN COLUMN 11 WHICH IS USED TO TEST THE COMPATIBILITY OF THE PRO-
C     BLEM WITH THE ELLPACK ROUTINES SELECTED IN THE ENCODED PROGRAM
C     (SEE ROUTINE COMPAT).  THIS INFORMATION BECOMES A COMMENT IN THE
C     GENERATED ELLPACK PROGRAM.
C
C     REMAINING LINES:  THE REMAINING LINES OF THE RECORD CONTAIN
C     INFORMATION COPIED INTO THE EQUATION, BOUNDARY AND FORTRAN SEG-
C     MENTS OF THE GENERATED ELLPACK PROGRAM IN THE ABOVE ORDER.
C     THE EQUATION, BOUNDARY AND FORTRAN CARDS ARE MARKED BY A 1, 2,
C     OR 3 IN COLUMN 1 RESPECTIVELY.  NOTE THAT FORTRAN CODE SHOULD
C     BEGIN IN COLUMN 7 AS USUAL AND THAT A FORTRAN COMMENT CAN BE
C     WRITTEN BY TYPING A C IN COLUMN 2.  FOR PORTABILITY PURPOSES,
C     THE END-OF-RECORD IS DETECTED BY THE PRESENCE OF A '-' (DASH)
C     IN COLUMN 1.
C
C  OPTFIL
C  ......
C
C     OPTFIL CONTAINS INFORMATION WHICH MAY BE USED TO GENERATE THE
C  OPTIONS SEGMENT OF THE ELLPACK PROGRAM.
C
C     OPTFIL IS DIVIDED UP INTO RECORDS WHICH ARE NUMBERED 0, 1, 2,...
C  ETC.  THE END-OF-RECORD IS DESIGNATED BY *EOR (*EOR ON NON-CDC
C  INSTALLATIONS).
C
C     RECORD 0 CONTAINS A DESCRIPTION OF THE PURPOSE AND ORGANIZATION
C  OF OPTFIL.  RECORDS 1, 2, 3,... HAVE THE FOLLOWING FORMAT:
C
C     LINE 1:  LINE 1 CONTAINS THE RECORD NUMBER.
C
C     LINE 2:  LINE 2 MUST CONTAIN THE 8 CHARACTERS OPTIONS. IN
C     COLUMNS 1-8, FOLLOWED ON THE SAME LINE BY ALL OF THE OPTIONS
C     [illegible].
C
C  [illegible]
C  ......
C
C     [illegible] CONTAINS INFORMATION WHICH MAY BE USED TO GENERATE THE
C  [illegible] SEGMENT OF THE ELLPACK PROGRAM.
C
C     [illegible] IS DIVIDED UP INTO RECORDS WHICH ARE NUMBERED 0, 1, 2,...
C  ETC.  THE END-OF-RECORD IS DESIGNATED BY *EOR (*EOR ON NON-CDC
C  INSTALLATIONS).
C
C     RECORD 0 CONTAINS A DESCRIPTION OF THE PURPOSE AND ORGANIZATION
C  OF [illegible].  RECORDS 1, 2, 3,... HAVE THE FOLLOWING FORMAT:
C
C     LINE 1:  LINE 1 CONTAINS THE RECORD NUMBER.
C
C     [illegible] THE REMAINING LINES OF THE RECORD CONTAIN THE
C     [illegible]
C     [illegible]
C     [illegible]
```

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C     DIRECTLY INTO THE GRID SEGMENT OF THE GENERATED ELLPACK PROGRAM.  COMPCOM
C     FOR PORTABILITY PURPOSES, THE END-OF-RECORD IS DETECTED BY THE    COMPCOM
C     PRESENCE OF A '-' (DASH) IN COLUMN 1.                             COMPCOM
C                                                                       COMPCOM
C  OUTFIL                                                               COMPCOM
C  ......                                                               COMPCOM
C                                                                       COMPCOM
C     OUTFIL CONTAINS INFORMATION WHICH MAY BE USED TO GENERATE THE     COMPCOM
C  OUTPUT SEGMENT OF THE ELLPACK PROGRAM.                               COMPCOM
C                                                                       COMPCOM
C     OUTFIL IS DIVIDED UP INTO RECORDS WHICH ARE NUMBERED 0, 1, 2,...  COMPCOM
C  ETC.  THE END-OF-RECORD IS DESIGNATED BY $EOR ('EOR ON NON-CDC       COMPCOM
C  INSTALLATIONS).                                                      COMPCOM
C                                                                       COMPCOM
C     RECORD 0 CONTAINS A DESCRIPTION OF THE PURPOSE AND ORGANIZATION   COMPCOM
C  OF OUTFIL.  RECORDS 1, 2, 3,... HAVE THE FOLLOWING FORMAT:           COMPCOM
C                                                                       COMPCOM
C     LINE 1:  LINE 1 CONTAINS THE RECORD NUMBER.                       COMPCOM
C                                                                       COMPCOM
C     REMAINING LINES:  THE REMAINING LINES OF THE RECORD CONTAIN THE   COMPCOM
C     OUTPUT SEGMENT EXACTLY AS IT WILL APPEAR IN THE GENERATED ELL-    COMPCOM
C     PACK PROGRAM.  TO SPECIFY AN ELLPACK CONTINUATION LINE, TYPE A    COMPCOM
C     '&' (AMP) IN COLUMN 2.  THE INFORMATION OF THIS RECORD IS COPIED  COMPCOM
C     DIRECTLY INTO THE OUTPUT SEGMENT OF THE GENERATED ELLPACK         COMPCOM
C     PROGRAM.  FOR PORTABILITY PURPOSES, THE END-OF-RECORD IS          COMPCOM
C     DETECTED BY THE PRESENCE OF A '-' (DASH) IN COLUMN 1.             COMPCOM
C                                                                       COMPCOM
C  NODATA                                                               COMPCOM
C  ......                                                               COMPCOM
C                                                                       COMPCOM
C     NODATA CONTAINS THE INFORMATION NEEDED TO DECODE ENCODED ELLPACK  COMPCOM
C  PROGRAMS AND CHECK COMPATIBILITY.                                    COMPCOM
C                                                                       COMPCOM
C     LINE 1 HAS THE NUMBER OF MODULES (NRMODS) IN I3 FORMAT.  NEXT     COMPCOM
C  FOLLOWS NRMODS PAIRS OF LINES.  THE FIRST OF EACH CONTAINS A UNIQUE  COMPCOM
C  INTEGER IN THE RANGE 1,...,NRMODS IN I3 FORMAT AND AN ELLPACK        COMPCOM
C  MODULE NAME STARTING IN COLUMN 6.  THESE GIVE THE CORRESPONDENCES    COMPCOM
C  BETWEEN MODULE NUMBERS USED IN ENCODED PROGRAMS AND THE NAMES OF     COMPCOM
C  OF MODULES TO BE USED IN THE GENERATED ELLPACK PROGRAM.  THE SECOND  COMPCOM
C  LINE OF THE PAIR CONTAINS A LIST OF INTEGERS IN 40I3 FORMAT          COMPCOM
C  THE MODULE NUMBERS THAT MAY IMMEDIATELY FOLLOW THIS MODULE IN        COMPCOM
C  ELLPACK PROGRAMS.  AFTER THIS SET OF LINES THERE IS ONE LINE         COMPCOM
C  CONTAINING A SINGLE INTEGER IN I3 FORMAT GIVING THE NUMBER OF        COMPCOM
C  DISCRETIZATION MODULES (NRDIS).  THIS IS FOLLOWED BY NRDIS LINES     COMPCOM
C  EACH BEGINNING A MODULE NUMBER IN I3 FORMAT AND 15 DIGITS            COMPCOM
C  STARTING IN COLUMN 5 GIVING MODULE COMPATIBILITY INFORMATION         COMPCOM
C  (SEE PROGRAM LIBRARY).                                               COMPCOM
C                                                                       COMPCOM
C  ******  ALL OUTPUT FILES MUST BE TERMINATED BY A CARD  *******       COMPCOM
C  ******  WITH A 9 IN COLUMN ONE.                        *******       COMPCOM
C                                                                       COMPCOM
C                                                                       COMPCOM
C     THE OUTPUT FILES PRODUCED BY COMPCOM ARE:                         COMPCOM
C                                                                       COMPCOM
C     [illegible] A SUMMARY OF USER ERRS, MESSAGES,                     COMPCOM
C     [illegible] ENCODED ELLPACK PROGRAMS, SEPARATED BY $EOR           COMPCOM
C     [illegible] THE FORTRAN I3A CHARACTERISTICS, AND                  COMPCOM
C     [illegible] ARE USED HERE FOR USER                                COMPCOM
C     [illegible], THE CURRENT MODULES WITH THE ENCODED                 COMPCOM
C     [illegible] ARE ORDERED HERE.  SEE FORMAT I/OS.                   COMPCOM
C                                                                       COMPCOM
C     [illegible] NUMBERS FOR THESE FILES ARE PRESCRIBED IN THE         COMPCOM
C     [illegible] PROGRAM.                                              COMPCOM
C                                                                       COMPCOM
C                                                                       COMPCOM
C  [illegible]                                                          COMPCOM
C  ----------                                                           COMPCOM
C                                                                       COMPCOM
C     [illegible] TO STANDARD FORTRAN (I3A) WHEREVER POSSIBLE.          COMPCOM
C     [illegible] ARE CALLED HOWEVER. THEY ARE:                         COMPCOM
C                                                                       COMPCOM
C     [illegible] FUNCTION RETURNS DATE IN A3 FORMAT. CALLED            COMPCOM
C     [illegible]                                                       COMPCOM
C     [illegible] FUNCTION RETURNS TIME IN A3 FORMAT. CALLED            COMPCOM
C     [illegible]                                                       COMPCOM
C     [illegible] ROUTINE TO ASSIGNMENT FOLLOWING THESE                 COMPCOM
```

[illegible] BE [illegible])

OFFSWICH -- [illegible] THAT TURNS OFF THE ITH SENSE SWITCH [illegible]

ONSWICH -- [illegible]

REWIND(METHOD) [illegible] THAT PLACES THE [illegible] [illegible] CARD LISTING. [illegible]

(ANY OF THESE LAST [illegible] ROUTINES MAY BE REMOVED SIMPLY BY DELETING THE CALLS.)

SKIP -- CDC ASSEMBLY LANGUAGE ROUTINE WHICH PROVIDES AUTOMATIC FILE AND/OR RECORD SKIPPING. SEE THE DISCUSSION BELOW ON SKIPPING FILES AND RECORDS.

THE PROGRAM CARD IN THE MAIN PROGRAM MUST BE REMOVED FOR NON-CDC INSTALLATIONS.

SKIPPING FILES AND RECORDS:

THE METHOD OF [illegible] PROGRAMS USED IN [illegible] ALLOWS THE ABILITY TO SKIP FILES AND/OR RECORDS ON FILES EDNFIL, MACFIL, OPTFIL, CRDFIL AND OUTFIL.

FOR EXAMPLE, IF THE ENCODED PROGRAM WERE TO REQUEST PROBLEM 5-3, IT WOULD BE NECESSARY TO SKIP FILES (PROBLEMS) ON EDNFIL TO FILE 5 AND THEN, WITHIN FILE 5, SKIP RECORDS (PARAMETER SETS) TO RECORD 3. MOREOVER, SINCE PROBLEM 5 CALLS MACRO 5, IT WOULD ALSO BE NECESSARY TO SKIP RECORDS (MACROS) ON MACFIL TO MACRO 5. SIMILAR SKIPPING MAY BE DONE ON OPTFIL, CRDFIL OR OUTFIL DEPENDING ON THE ENCODED PROGRAM.

IN ORDER TO AVOID THE SLOW PROCESS OF SCANNING THROUGH THESE FILES LINE BY LINE TO FIND THE DESIRED FILES AND/OR RECORDS, WE HAVE TAKEN ADVANTAGE OF SOME NON-PORTABLE FEATURES [illegible] CDC INSTALLATION. THE END-OF-FILE AND END-OF-RECORD MARKERS, EOF AND EOR RESPECTIVELY [illegible], HAVE SPECIAL MEANINGS TO THE CDC FILE SYSTEM. WE PROVIDE FOR CDC INSTALLATIONS THE [illegible] ASSEMBLY LANGUAGE [illegible] SKIP WHICH USES THESE MARKERS TO GIVE [illegible] SKIPPING OF FILES AND/OR RECORDS.

[illegible]

[illegible]

```
C     CLEN   = ACTUAL LENGTH OF ENCODED INPUT STRING.                          GENPCM   301
C     PTR    = CURRENT POSITION IN CODE.                                       GENPCM   302
C     FILE   = FILE CURRENTLY BEING PROCESSED.                                 GENPCM   303
C     LINE   = CURRENT CARD FROM FILE FILE. (VECTOR)                           GENPCM   304
C     PTYPE  = PROBLEM TYPE, USE ROUTINE COMPAT. (VECTOR)                      GENPCM   305
C     PCHAR  = PROBLEM CHARACTERISTICS. (VECTOR)                               GENPCM   306
C     ...MOD = ELLPACK MODULE NUMBER, WHERE ... IS EITHER DIS, IND, OR         GENPCM   307
C              SOL.                                                            GENPCM   308
C     ...REC = RECORD NUMBER IN FILE ...FIL, WHERE ... MAY BE                  GENPCM   309
C              EQN,OPT,OUT,GRD.                                                GENPCM   310
C     ALG... = POINTER TO START (ALGST) OR TO END (ALGEND) OF THE              GENPCM   311
C              METHOD SPECIFICATION IN THE INPUT STRING CODE.                  GENPCM   312
C     DISPAR = POINTER TO START OF DISCRETIZATION MODULE PARAMETERS            GENPCM   313
C              IN THE ENCODED INPUT STRING CODE.                               GENPCM   314
C     COMENT = THE COMMENT IN THE ENCODED INPUT STRING CODE. (VECTOR)          GENPCM   315
C     FATAL  = SWITCH INDICATING WHETHER AN ERROR HAS BEEN DETECTED.           GENPCM   316
C     PROBNO = PROBLEM NUMBER FROM EQNFIL.                                     GENPCM   317
C     PPARM  = PROBLEM PARAMETERS FROM EQNFIL (VECTOR).                        GENPCM   318
C                                                                              GLOBAL     1
C  GLOBAL VARIABLES                                                            GLOBAL     2
C                                                                              GLOBAL     3
      INTEGER EQNFIL,GRDFIL,OPTFIL,OUTFIL,MACFIL,PGMFIL,PARAM,COMMA,           GLOBAL     4
     $        SLASH,LPAREN,RPAREN,BLANK,AMP,E,ZERO,ONE,TWO,THREE,SIX,          GLOBAL     5
     $        MODNUM,DMTYPE,VALID,LEVEL,DOT,NULL,NRMODS,                       GLOBAL     6
     $        NUDCOL,STAR,DOLLAR,HEADER,DIGIT,LETTER,MODATA,DASH               GLOBAL     7
      LOGICAL FATAL                                                            GLOBAL     8
      COMMON / GLOBAL / EQNFIL,GRDFIL,OPTFIL,OUTFIL,MACFIL,PGMFIL,             GLOBAL     9
     $                  HEADER,COMMA,SLASH,LPAREN,RPAREN,BLANK,AMP,E,         GLOBAL    10
     $                  DOT,DOLLAR,STAR,NULL,ZERO,ONE,TWO,THREE,SIX,          GLOBAL    11
     $                  MODATA,DASH,                                          GLOBAL    12
     $                  PARM(10,35),MODNAM(70,10),DMTYPE(70,15),              GLOBAL    13
     $                  VALID(70,20),IZERO3(15),DIGIT(10),LETTER(10),         GLOBAL    14
     $                  LEVEL,NRMODS,NUDCOL,FATAL                             GLOBAL    15
C                                                                              GLOBAL    16
      DATA CODIM/400/,NRTYPE/15/,CHARC/1HC/                                    GENPCM   400
C                                                                              GENPCM   401
C  READ TABLE OF MODULE INFORMATION                                            GENPCM   402
C                                                                              GENPCM   403
C     READ PAST FILE DOCUMENTATION                                             GENPCM   404
C                                                                              GENPCM   405
   2  READ(MODATA,2042)CHAR                                                    GENPCM   406
      IF (CHAR .NE. DASH) GO TO 2                                              GENPCM   407
C                                                                              GENPCM   408
      READ(MODATA,2033)NRMODS                                                  GENPCM   409
      IF (LEVEL .GT. 2)  WRITE(6,2032) NRMODS                                  GENPCM   410
      DO 5 I=1,NRMODS                                                          GENPCM   411
         READ(MODATA,203)) N,(MODNAM(N,K),K=1,10)                              GENPCM   412
         NP1 = N+1                                                             GENPCM   413
         READ(MODATA,2035) (VALID(NP1,K),K=1,20)                               GENPCM   414
         IF (LEVEL .LE. 2)  GO TO 5                                            GENPCM   415
            NONZ = 0                                                           GENPCM   416
            DO 3 J=1,20                                                        GENPCM   417
               NONZ = NONZ + 1                                                 GENPCM   418
               IF (VALID(NP1,NONZ) .LE. 0)  GO TO 4                            GENPCM   419
    3       CONTINUE                                                           GENPCM   420
    4       CONTINUE                                                           GENPCM   421
            WRITE(6,2035) N,(MODNAM(N,K),K=1,10),(VALID(NP1,K),K=1,NONZ)       GENPCM   422
    5 CONTINUE                                                                 GENPCM   423
      READ(MODATA,2029) NRDIS                                                  GENPCM   424
      IF (LEVEL .GT. 2)  WRITE(6,2034) NRDIS                                   GENPCM   425
      DO 10 I=1,NRDIS                                                          GENPCM   426
         READ(MODATA,2031) N,(DMTYPE(N,K),K=1,NRTYPE)                          GENPCM   427
         VALID(1,I) = N                                                        GENPCM   428
         IF (LEVEL .GT. 2)  WRITE(6,2035) N,(DMTYPE(N,K),K=1,NRTYPE)           GENPCM   429
   10 CONTINUE                                                                 GENPCM   430
      VALID(1,NRDIS+1) = 0                                                     GENPCM   431
C                                                                              GENPCM   432
C  GET ENCODED PROBLEM                                                         GENPCM   433
C                                                                              GENPCM   434
      FATAL = .FALSE.                                                          GENPCM   435
      WRITE(6,2001)                                                            GENPCM   436
      CALL INCODE(CODE,CODIM,CLEN,PTR)                                         GENPCM   437
   20 CONTINUE                                                                 GENPCM   438
      IF (CLEN .EQ. 0)  GO TO 999                                              GENPCM   439
C                                                                              GENPCM   440
C     GET PROBLEM NUMBER                                                       GENPCM   441
```

```
C
      [illegible]
      [illegible]
      [illegible] = NUMBER(CODE,PTR)
      IF ([illegible] .EQ. 0) CALL ERREND(12,0)
C
C     SKIP [illegible] TO PROBLEM NUMBER
C
      CALL SKIPF(PROBID,EONFIL)
C
C     VALIDATE PROBLEM NUMBER
C
      READ(EONFIL,2003)PRCHEK
      IF (PROBID .NE. PRCHEK) CALL ERREND(5,EONFIL)
C
C     CHECK FOR PARAMETER SET NUMBER
C
      IF ([illegible](PTR-1) .EQ. [illegible]) .OR.
     S    [illegible](PTR-1) .EQ. [illegible]) .OR.
     S    [illegible](PTR-1) .EQ. [illegible])          GO TO 21
        [illegible]
        [illegible] SKIPR([illegible],EONFIL)
        [illegible] 23
   21 CONTINUE
C
C     SKIP RECORDS TO PARAMETER SET
C
      [illegible]NUMBER(CODE,PTR)
      IF ([illegible] .EQ. 0) [illegible]=1
      CALL SKIPR([illegible]-1,EONFIL)
C
C     VALIDATE PARAMETER SET NUMBER AND GET PARAMETER INFO
C
   23 CONTINUE
      READ(EONFIL,2011)NPSCHEK,(PCPARM(I),I=1,50)
      [illegible]
      IF ([illegible] .EQ. 0) NPSCHEK=1
      IF ([illegible] .NE. NPSCHEK) CALL ERREND(7,EONFIL)
      CALL [illegible](EONFIL,LINE)
      [illegible] ([illegible](I),I=1,CLEN)
      [illegible] ([illegible], (PRPARM(I),I=1,50),
     S                 (LINE(I),I=7,80))
      [illegible] = 0
      DO [illegible] K=1,4
        [illegible] = 10*K+1
        [illegible] = [illegible]+9
        DO [illegible] I=[illegible],ILAST
          [illegible] = [illegible]+1
          [illegible] = LINE(I)
   [illegible] CONTINUE
        [illegible] = [illegible]+1
        [illegible] = BLANK
   [illegible] CONTINUE
C
C     [illegible]
C
      [illegible]
      [illegible] CALL [illegible](LINE,[illegible])
C
C     [illegible]
C
      [illegible]
      DO [illegible]
        [illegible]
        [illegible] LINE(I)
   [illegible] CONTINUE
      [illegible] (LINE(I),I=11,[illegible])
C
C     [illegible]
C
      [illegible]
      [illegible] CALL [illegible](LINE,.TRUE.)
      [illegible]
      [illegible]
```

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```
      CALL COPYR3(FILE,PGMFIL,BLANK,THREE,LINE,.FALSE.)                 GENPC01   510
C                                                                       GENPC01   520
C     GENERATE FORTRAN SEGMENT                                          GENPC01   530
C                                                                       GENPC01   540
      WRITE(PGMFIL,2014)                                                GENPC01   550
40    CONTINUE                                                          GENPC01   560
      IF (LINE(1) .EQ. DASH)  GO TO 42                                  GENPC01   570
         LINE(1) = BLANK                                                GENPC01   580
         IF (LINE(2) .EQ. CHARC)  LINE(1) = CHARC                       GENPC01   590
         IF (LINE(1) .EQ. CHARC)  LINE(2) = BLANK                       GENPC01   600
         WRITE(PGMFIL,2007) (LINE(J),J=1,80)                            GENPC01   610
         CALL GETLINE(FILE,LINE)                                        GENPC01   620
         GO TO 40                                                       GENPC01   630
42    CONTINUE                                                          GENPC01   640
C                                                                       GENPC01   650
C     PROCESS OPTIONS RECORD                                            GENPC01   660
C                                                                       GENPC01   670
C        NOTE--- THE PREPROCESSOR LIMITS OPTIONS SEGMENTS TO ONE        GENPC01   680
C                LINE EACH, HENCE WE ASSUME OPTIONS FILE RECORDS        GENPC01   690
C                HAVE THE WORD OPTIONS. AT THE START OF EACH LINE.      GENPC01   700
C                                                                       GENPC01   710
      OPTREC = NUMBER(CODE,PTR)                                         GENPC01   720
      IF (OPTREC .EQ. 0)  GO TO 45                                      GENPC01   730
C                                                                       GENPC01   740
C     SKIP RECORDS TO OPTION                                            GENPC01   750
C                                                                       GENPC01   760
         REWIND OPTFIL                                                  GENPC01   770
         CALL SKIPR(OPTREC,OPTFIL)                                      GENPC01   780
C                                                                       GENPC01   790
C     VALIDATE OPTION NUMBER                                            GENPC01   800
C                                                                       GENPC01   810
         READ(OPTFIL,80)NUMOPT                                          GENPC01   820
         IF (NUMOPT .NE. OPTREC) CALL ERREND(8,OPTFIL)                  GENPC01   830
         CALL COPYR3(OPTFIL,PGMFIL,NULL,DASH,LINE,.TRUE.)               GENPC01   840
         GO TO 50                                                       GENPC01   850
C                                                                       GENPC01   860
C        USE DEFAULT SEGMENT                                            GENPC01   870
45       CONTINUE                                                       GENPC01   880
         WRITE(PGMFIL,2083)                                             GENPC01   890
50    CONTINUE                                                          GENPC01   900
C                                                                       GENPC01   910
C     PROCESS GRID SEGMENT                                              GENPC01   920
C                                                                       GENPC01   930
      GRDREC = NUMBER(CODE,PTR)                                         GENPC01   940
      IF (CODE(PTR-1) .EQ. SLASH)  GO TO 90                             GENPC01   950
C                                                                       GENPC01   960
C        UNIFORM GRID SIZE IS GIVEN IN ENCODED PROGRAM                  GENPC01   970
         NX = PTR+2                                                     GENPC01   980
         NY = NUMBER(CODE,PTR)                                          GENPC01   990
         NZ = 0                                                         GENPC01  1000
         IF (CODE(PTR-1) .EQ. COMMA)  NZ = NUMBER(CODE,PTR)             GENPC01  1010
         PTYPE(4) = ZERO                                                GENPC01  1020
         PTYPE(5) = ONE                                                 GENPC01  1030
         IF ((NX .EQ. 2), (NY .AND. ((NZ .EQ. NZ) .OR. (NZ .EQ. 0)))    GENPC01  1040
     $      PTYPE(5) = TWO                                              GENPC01  1050
         WRITE(PGMFIL,2002) NX,NY                                       GENPC01  1060
         IF (NZ .GT. 1)  WRITE(PGMFIL,2003) NZ                          GENPC01  1070
         GO TO 70                                                       GENPC01  1080
C                                                                       GENPC01  1090
C        NON-UNIFORM GRID GIVEN IN FILE GRDFIL                          GENPC01  1100
C                                                                       GENPC01  1110
60       CONTINUE                                                       GENPC01  1120
         PTYPE(4)=ZERO                                                  GENPC01  1130
         PTYPE(5) = ZERO                                                GENPC01  1140
C                                                                       GENPC01  1150
C     SKIP TOO MUCH TO GRID                                             GENPC01  1160
C                                                                       GENPC01  1170
         REWIND GRDFIL                                                  GENPC01  1180
         CALL SKIPR(GRDREC-GRDFIL)                                      GENPC01  1190
C                                                                       GENPC01  1200
C     VALIDATE GRID NUMBER                                              GENPC01  1210
C                                                                       GENPC01  1220
         READ(GRDFIL,80) NGRID                                          GENPC01  1230
         IF (NGRID .NE. GRDREC) CALL ERREND(10,GRDFIL)                  GENPC01  1240
         BACKSPACE(GRDFIL)                                              GENPC01  1250
         CALL COPYR3(GRDFIL,PGMFIL,BLANK,DASH,LINE,.TRUE.)              GENPC01  1260
```

```
   70     CONTINUE
C
C      PROCESS INTERPRETATION SEGMENT
C
          OLDPT = PTR
          [illegible] = NUMBER(CODE,PTR)
          [illegible] = PTR
          IF ([illegible]) .GT. NRUNTS)  GO TO 300
          IF ([illegible] .EQ. 0)  GO TO 75
             WRITE(PTNFIL,2010)
             CALL WRTMOD(DISMOD,CODE,CLEN,PTR)
   75     CONTINUE
C
C      PROCESS INDEXING SEGMENT
C
          INDMOD = NUMBER(CODE,PTR)
          IF ([illegible] .GT. NRUNTS)  GO TO 300
          IF ([illegible] .EQ. 0)  GO TO 80
             WRITE(PRNFIL,2005)
             CALL WRTMOD(INDMOD,CODE,CLEN,PTR)
   80     CONTINUE
C
C      PROCESS SOLUTION SEGMENT
C
          SOLMOD = NUMBER(CODE,PTR)
          IF (SOLMOD .GT. NRUNTS)  GO TO 300
          IF (SOLMOD .EQ. 0)  GO TO 90
             WRITE(PRNFIL,2003)
             CALL WRTMOD(SOLMOD,CODE,CLEN,PTR)
   90     CONTINUE
          ALGEND = PTR-1
C
C      PROCESS OUTPUT RECORD
C
          OUTREC = NUMBER(CODE,PTR)
          IF (OUTREC .EQ. 0)  GO TO 95
C
C         SKIP RECORDS TO OUTPUT RECORD
C
             REWIND OUTFIL
             CALL SKIPR(OUTREC,OUTFIL)
C
C         VALIDATE OUTPUT RECORD
C
          READ(OUTFIL,2040) NOUTREC
          IF (NOUTREC .NE. OUTREC) CALL ERREND(11,OUTFIL)
             WRITE(PRNFIL,2007)
             CALL OTPTRD(OUTFIL,PRNFIL,BLANK,DASH,LINE,.TRUE.)
             GO TO 100
C
C            USE DEFAULT SEGMENT
   95        CONTINUE
             WRITE(PRNFIL,2027)
  100     CONTINUE
C
C      WRITE A SEQUENCE SEGMENT ONTO THE ELPACK INPUT PROGRAM
C
          WRITE(PRNFIL,2010)
          IF ([illegible] .NE. 0)  WRITE(PRNFIL,[illegible])
          IF ([illegible] .NE. 0)  WRITE(PRNFIL,[illegible])
          IF ([illegible] .NE. 0)  WRITE(PRNFIL,[illegible])
          WRITE(PRNFIL,2010)
          IF ([illegible] .NE. 0)  WRITE(PRNFIL,[illegible])
C
C      CHECK [illegible] COMPATIBILITY AND MODULE SEQUENCE LEGALITY
C
          IF ([illegible] .LT. 1)  GO TO [illegible]
             IF ([illegible] .EQ. 0)
     *          WRITE(PRNFIL,[illegible]) [illegible]
     *                            [illegible]
     *                            [illegible]
             IF [illegible]
     *          [illegible]
     *                            [illegible]
     *                            [illegible]
  10[illegible]   [illegible]
```

```
      CALL [illegible],NZ,[illegible],CODE,CLEN)
      [illegible]
C
C     [illegible]
C
      [illegible]
      [illegible]
C
C     [illegible] FROM [illegible]
      [illegible]
      [illegible] = BLANK
110   [illegible]
      J = [illegible]
120   CONTINUE
      IF ([illegible] .EQ. BLANK) .OR. (J .GE. 100))  GO TO 130
      J = J+1
      [illegible] = CODE(PTR)
      PTR = [illegible]
      GO TO 1[illegible]
130   CONTINUE
C
C     [illegible] UP [illegible] DATE AND CURRENT TIME
      [illegible] = [illegible]
      [illegible] = [illegible]
C
C     [illegible] HEADER FILE
      IF ([illegible] .EQ. DOLLAR)
    $ [illegible] 2025) [illegible],NPMEET,RDATE,RTIME,
    $                   (COMENT(I),I=1,100),(PRPARM(I),I=1,50),
    $                   (PTYPE(I),I=1,15),(PCHAR(I),I=1,27),
    $                   (CODE(I),I=ALCST,ALCEND))
C
C     READ NEXT PROBLEM
C
200   CONTINUE
      CALL INCODE(CODE,CODEN,CLEN,PTR)
C
      GO TO 20
C
C ABNORMAL TERMINATION OF GENERATED PROGRAM
C
800 CONTINUE
      FATAL = .TRUE.
      WRITE(POUFIL,2015) STAR,STAR,STAR
      WRITE(6,2015) BLANK,BLANK,BLANK
      [illegible]
      END FILE POUFIL
      GO TO [illegible]
C
C PROGRAM EXIT
C
900 CONTINUE
      CALL [illegible](1)
      [illegible] CALL ERREND(1,[illegible])
      [illegible]
C
C-----------------------------------------------------------------------
[illegible]
      [illegible] COMPARISON TEST
      [illegible]
      [illegible] PROGRAM [illegible]
      [illegible]
      [illegible]
      [illegible],LONGITUDE Y =,[illegible]
      [illegible]
      [illegible]
```

```
     $   /1H*,10X,24HOPTIONS RECORD          = ,I3                          GENPCM
     $   /1H*,10X,34HDISCRETIZATION MODULE = ,I3,3X,6H(TYPE=,15A1,1H)       GENPCM
     $   /1H*,10X,24HINDEXING MODULE         = ,I3                          GENPCM
     $   /1H*,10X,24HSOLUTION MODULE         = ,I3                          GENPCM
     $   /1H*,10X,24HOUTPUT RECORD           = ,I3   )                      GENPCM
 2011 FORMAT(1H*,22X,13A1)                                                  GENPCM
 2012 FORMAT(9HEQUATION.)                                                   GENPCM
 2013 FORMAT(9HBOUNDARY.)                                                   GENPCM
 2014 FORMAT(8HFORTRAN.)                                                    GENPCM
 2015 FORMAT(A1/A1,29H------ ERROR IN INPUT                                 GENPCM
     $          /A1,31H      MODULE NUMBER TOO LARGE   )                    GENPCM
 2017 FORMAT(1H*/9HSEQUENCE.)                                               GENPCM
 2020 FORMAT(14X,14HDISCRETIZATION)                                         GENPCM
 2021 FORMAT(14X,8HINDEXING)                                                GENPCM
 2022 FORMAT(14X,8HSOLUTION)                                                GENPCM
 2023 FORMAT(14X,6HOUTPUT)                                                  GENPCM
 2024 FORMAT(5HGRID.)                                                       GENPCM
 2025 FORMAT(/2I4,3X,A3,1X,A3,2X,100A1/4X,50A1,3X,13A1,5X,27A1              GENPCM
     $         /20A1)                                                       GENPCM
 2026 FORMAT(41HOPTIONS,   TIME   $   MEMORY   $   LEVEL=0     )            GENPCM
 2027 FORMAT(1H*/40HOUTPUT.     MAX-U   $   MAX(20,20)-ERROR    )           GENPCM
 2028 FORMAT(14X,4HTEST)                                                    GENPCM
 2029 FORMAT(I3)                                                            GENPCM
 2030 FORMAT(I3,2X,10A4)                                                    GENPCM
 2031 FORMAT(I3,2X,80A1)                                                    GENPCM
 2032 FORMAT(1H1,100(1H-)/33X,21HM O D U L E   D A T A/1X,100(1H-)///       GENPCM
     $         7X,20HNUMBER OF MODULES = ,I5///                             GENPCM
     $         1X,6HNUMBER,12X,4HNAME,31X,                                  GENPCM
     $         18HLEGAL FOLLOWERS/2X,6(1H-),12X,4(1H-),31X,15(1H-)/)        GENPCM
 2033 FORMAT(2X,I4,8X,10A4,1X,20I3)                                         GENPCM
 2034 FORMAT(//1X,9HTHERE ARE ,I3,34H DISCRETIZATION MODULES.  THEY ARE     GENPCM
     $         //3X,13HMODULE NUMBER,4X,18HCOMPATIBILITY INFO/              GENPCM
     $         3X,13(1H-),4X,18(1H-)/)                                      GENPCM
 2035 FORMAT(3X,I4,10X,30A1)                                                GENPCM
 2036 FORMAT(4X,20I3)                                                       GENPCM
 2037 FORMAT(80A1)                                                          GENPCM
 2038 FORMAT(/T11,I3/)                                                      GENPCM
 2040 FORMAT(T8,I3)                                                         GENPCM
 2041 FORMAT(T16,I3,50A1)                                                   GENPCM
 2042 FORMAT(A1)                                                            GENPCM
 3000 FORMAT(I1)                                                            GENPCM
C                                                                           GENPCM
      END                                                                   GENPCM
      BLOCK DATA                                                            GENPCM
C                                                                           GENPCM
C  THIS BLOCK DATA SUBPROGRAM PERFORMS TABLE INITIALIZATIONS FOR            GENPCM
C  THE PROGRAM GENPCM                                                       GENPCM
C                                                                           GENPCM
C                                                                           GLOBAL
C  GLOBAL VARIABLES                                                         GLOBAL
C                                                                           GLOBAL
      INTEGER [illegible]FIL,[illegible]FIL,CPYFIL,OUTFIL,MODFIL,PGMFIL,PARAM,COMMA,  GLOBAL
     $        [illegible],LPAREN,RPAREN,BLANK,AMP,E,ZERO,ONE,TWO,THREE,SIX,  GLOBAL
     $        [illegible],ENTYPE,VALID,LEVEL,[illegible],NULL,NCMODS,        GLOBAL
     $        [illegible],STAR,DOLLAR,HEADER,DIGIT,LETTER,MODATA,DASH        GLOBAL
      LOGICAL FATAL                                                         GLOBAL
      COMMON / GLOBAL / [illegible]FIL,[illegible]FIL,CPYFIL,OUTFIL,MODFIL,PGMFIL,  GLOBAL
     $                  [illegible],COMMA,SLASH,LPAREN,RPAREN,BLANK,AMP,E,   GLOBAL
     $                  [illegible],DOLLAR,STAR,NULL,ZERO,ONE,TWO,THREE,SIX, GLOBAL
     $                  MODATA,DASH,                                        GLOBAL
     $                  PARAM(10,75),MODNAM(70,10),ENTYPE(70,15),           GLOBAL
     $                  VALID(70,70),[illegible](10),DIGIT(10),LETTER(10),  GLOBAL
     $                  LEVEL,NCMODS,NUMMOD,FATAL                           GLOBAL
C                                                                           GLOBAL
C  INITIALIZE CONSTANTS                                                     GENPCM
C                                                                           GENPCM
C     MEANING OF SELECTED CONSTANTS ----                                    GENPCM
C        [illegible]FIL,[illegible]FIL,CPYFIL,MODFIL,PGMFIL,HEADER,MODATA = GENPCM
C               FORTRAN IO UNIT NUMBERS                                     GENPCM
C        LEVEL = DEBUG PRINT LEVEL. MAY BE 1 TO 5.                          GENPCM
C        [illegible] = NUMBER OF COLUMNS IN THE ARRAY VALID                 GENPCM
C                                                                           GENPCM
      DATA                                                                  GENPCM
     $  [illegible]FIL,[illegible]FIL,OUTFIL,MODFIL,PGMFIL,CPYFIL,HEADER,MODATA  GENPCM
     $  / [illegible], [illegible], [illegible], [illegible], [illegible], [illegible], [illegible], 10/,  GENPCM
     $  [illegible],COMMA,LPAREN,RPAREN,BLANK,AMP,E,[illegible],STAR,DOLLAR  GENPCM
```

```
     $    / 1H,,  1H/,   1H(,   1H),  1H ,1H=,1HE,1H.,  1H*,   1H$/,     CENPGM     807
     $     ZERO,ONE,TWO,THREE,SIX,NULL,DASH                               CENPGM     808
     $    / 1H0,1H1,1H2,  1H3,1H5,5H333,1H-/,                             CENPGM     809
     $     LEVEL,NVDCOL                                                   CENPGM     810
     $    /    3,    20/,                                                 CENPGM     811
     $     DIGIT(1),DIGIT(2),DIGIT(3),DIGIT(4),DIGIT(5),DIGIT(6),         CENPGM     812
     $     DIGIT(7),DIGIT(8),DIGIT(9),DIGIT(10)                           CENPGM     813
     $    /1H0,1H1,1H2,1H3,1H4,1H5,1H6,1H7,1H8,1H9/,                      CENPGM     814
     $     LETTER(1),LETTER(2),LETTER(3),LETTER(4),LETTER(5),LETTER(6),   CENPGM     815
     $     LETTER(7),LETTER(8),LETTER(9),LETTER(10)                       CENPGM     816
     $    /1HA,1HB,1HC,1HD,1HE,1HF,1HG,1HH,1HI,1HJ/                       CENPGM     817
C                                                                         CENPGM     818
      END                                                                 CENPGM     819
      SUBROUTINE INCODE (CODE,CODIM,CLEN,PTR)                             INCODE       1
C                                                                         INCODE       2
C  INCODE READS THE ENCODED ELLPACK PROGRAM FROM IO UNIT 5. THE INPUT     INCODE       3
C  IS ASSUMED TO START ON A NEW CARD AND CARDS ARE READ UNTIL THE          INCODE       4
C  INPUT IS COMPLETE (I.E. 3 SLASHES ARE FOUND). THE VARIABLE CODIM       INCODE       5
C  GIVES THE MAX ALLOWABLE LENGTH OF THE INPUT STRING. BLANKS ARE         INCODE       6
C  SQUEEZED OUT OF THE INPUT AND THE RESULTING STRING IS PLACED IN        INCODE       7
C  THE ARRAY CODE. THE LENGTH OF THE STRING IS THEN CLEN.                 INCODE       8
C  PTR IS INITIALIZED TO 1.                                               INCODE       9
C                                                                         INCODE      10
      INTEGER CODE(400),CODIM,CLEN,PTR                                    INCODE      11
C                                                                         GLOBAL       1
C  GLOBAL VARIABLES                                                       GLOBAL       2
C                                                                         GLOBAL       3
      INTEGER CONFIL,GRDFIL,OPTFIL,OUTFIL,MACFIL,PGMFIL,PARAM,COMMA,      GLOBAL       4
     $        SLASH,LPAREN,RPAREN,BLANK,AMP,E,ZERO,ONE,TWO,THREE,SIX,     GLOBAL       5
     $        MODNAM,DMTYPE,VALID,LEVEL,DOT,NULL,NRMODS,                  GLOBAL       6
     $        NVDCOL,STAR,DOLLAR,HEADER,DIGIT,LETTER,MODATA,DASH          GLOBAL       7
      LOGICAL FATAL                                                       GLOBAL       8
      COMMON / GLOBAL / CONFIL,GRDFIL,OPTFIL,OUTFIL,MACFIL,PGMFIL,        GLOBAL       9
     $                  HEADER,COMMA,SLASH,LPAREN,RPAREN,BLANK,AMP,E,    GLOBAL      10
     $                  DOT,DOLLAR,STAR,NULL,ZERO,ONE,TWO,THREE,SIX,     GLOBAL      11
     $                  MODATA,DASH,                                     GLOBAL      12
     $                  PARAM(10,35),MODNAM(70,10),DMTYPE(70,15),        GLOBAL      13
     $                  VALID(70,20),IZEROS(15),DIGIT(10),LETTER(10),    GLOBAL      14
     $                  LEVEL,NRMODS,NVDCOL,FATAL                        GLOBAL      15
C                                                                         GLOBAL      16
      PTR = 1                                                             INCODE      13
      IBEGIN = 1                                                          INCODE      14
      IEND = 80                                                           INCODE      15
      NSLASH = 0                                                          INCODE      16
      NONBLK = 0                                                          INCODE      17
   10 CONTINUE                                                            INCODE      18
C        CHECK IF INPUT IS TOO LONG                                       INCODE      19
         IF (IEND .GT. CODIM)  GO TO 600                                  INCODE      20
         READ(5,1000) (CODE(I),I=IBEGIN,IEND)                            INCODE      21
         IF (CODE(1) .EQ. DOLLAR)  GO TO 500                              INCODE      22
         DO 20 I=IBEGIN,IEND                                              INCODE      23
C           IGNORE BLANKS                                                 INCODE      24
            IF (CODE(I) .EQ. BLANK)  GO TO 20                             INCODE      25
            NONBLK = NONBLK+1                                             INCODE      26
            CODE(NONBLK) = CODE(I)                                        INCODE      27
C           COUNT SLASHES                                                 INCODE      28
            IF (CODE(NONBLK) .EQ. SLASH)  NSLASH = NSLASH+1               INCODE      29
   20    CONTINUE                                                         INCODE      30
         IBEGIN = NONBLK+1                                                INCODE      31
         IEND = IBEGIN+79                                                 INCODE      32
C        CHECK IF INPUT IS COMPLETE                                       INCODE      33
         IF (NSLASH .LT. 3)  GO TO 10                                     INCODE      34
      CLEN = NONBLK                                                       INCODE      35
      IF (LEVEL .GT. 0)  WRITE(6,2000) (CODE(I),I=1,CLEN)                 INCODE      36
      RETURN                                                              INCODE      37
C                                                                         INCODE      38
C  END OF DATA                                                            INCODE      39
C                                                                         INCODE      40
  500 CONTINUE                                                            INCODE      41
      CLEN = 0                                                            INCODE      42
      RETURN                                                              INCODE      43
C                                                                         INCODE      44
C  ERROR IN INPUT                                                         INCODE      45
C                                                                         INCODE      46
  600 CONTINUE                                                            INCODE      47
      FATAL = .TRUE.                                                      INCODE      48
```

```
      WRITE(CONFIL,3001) STAR,STAR,STAR,STAR,(CODE(I),I=1,20)
      WRITE(6,1001) BLANK,BLANK,BLANK,BLANK,(CODE(I),I=1,20)
      STOP
C
 1000 FORMAT(20A1)
 2000 FORMAT('0**** ,'ERRONEOUS CALLBACK PROGRAM /CH  ,20(1H-)/
     S       (1H ,CR(20A1))
 2001 FORMAT(0(1/01,22H------ ERROR ON INPUT
     S       /01,7X,'INPUT STRING TOO LONG
     S       /01,7X,16HFIRST CARD = ,80A1  )
C
      END
      INTEGER FUNCTION NUMBER (CODE,PTR)
C
C  NUMBER CONVERTS CHARACTERS IN THE ARRAY CODE (C90&) TO A DECIMAL
C  INTEGER.  CONVERSION BEGINS WITH THE CHARACTER CODE(PTR) AND
C  STOPS WHEN ONE OF THE CHARACTERS /,(&$ IS ENCOUNTERED.
C
      INTEGER CODE(490),PTR,CHAR
C
C  GLOBAL VARIABLES
C
      INTEGER CONFIL,ERRFIL,DBFFIL,OUTFIL,MODFIL,PSWFIL,PARAM,COMMA,
     S        SLASH,LPAREN,RPAREN,BLANK,AMP,E,ZERO,ONE,TWO,THREE,SIX,
     S        MINUS,PNTYPE,UNLID,LEVEL,EOT,NULL,MINUS1,
     S        NUMBAL,STAR,DOLLAR,NEWREC,DIGIT,LETTER,LODATA,EACH
      LOGICAL FATAL
      COMMON / GLOBAL / CONFIL,ERRFIL,DBFFIL,OUTFIL,MODFIL,PSWFIL,
     S                  NEWREC,PARAM,COMMA,SLASH,LPAREN,RPAREN,BLANK,AMP,E,
     S                  EOT,DOLLAR,STAR,NULL,ZERO,ONE,TWO,THREE,SIX,
     S                  MINUS,EACH,
     S                  PARAM(10,3),UNLID(70,10),PNTYPE(70,10),
     S                  UNLID(70,21),DIGIT(10),LETTER(10),
     S                  LEVEL,MAXDIM,NUMBAL,FATAL
C
      N = 0
      K = PTR
   10 CONTINUE
      CHAR = CODE(K)
C     CHECK FOR END OF NUMBER
      IF ((CHAR .EQ. SLASH ) .OR. (CHAR .EQ. COMMA ) .OR.
     S    (CHAR .EQ. RPAREN) .OR. (CHAR .EQ. LPAREN) .OR.
     S    (CHAR .EQ. DOLLAR) .OR. (CHAR .EQ. BLANK ) .OR.
     S    (CHAR .EQ. EOT   ))                                    GO TO 50
C        FIND WHICH DIGIT IS IN CHAR
         DO 15 J=1,10
            IDIGIT = J-1
            IF (CHAR .EQ. DIGIT(J))  GO TO 20
   15    CONTINUE
C        NOT A DIGIT
         CALL ERREND(3,CHAR)
   20    CONTINUE
C        DIGIT FOUND
         N = 10*N + IDIGIT
         K = K+1
         GO TO 10
   50 CONTINUE
      NUMBER = N
      PTR = K+1
      IF (LEVEL .GT. 3)  WRITE(3,3000) NUMBER
      RETURN
C
 3000 FORMAT('0N NUMBER=,I10)
C
      END
      SUBROUTINE GETLN (FILE,LINE)
C
C  GETLN RETURNS THE NEXT LINE (C80A) FROM THE GIVEN FILE.
C  IF FILE EQ PSW (PSWFIL) FILE THE LINE IS ASSUMED FOR SUBMIT
C  PARAMETERS UNLESS THE FIRST CHARACTER
C
      INTEGER FILE,LINE(20),PSWLIN(20),ELT
C
C  GLOBAL VARIABLES
C
      INTEGER CONFIL,ERRFIL,DBFFIL,OUTFIL,MODFIL,PSWFIL,PARAM,COMMA,
```

```
     $        SLASH,LPAREN,RPAREN,BLANK,AMP,E,ZERO,ONE,TWO,THREE,SIX,    GLOBAL      5
     $        NORMAL,INTYPE,VALID,LEVEL,TOT,NULL,NRMODS,                 GLOBAL      6
     $        NUMBOL,STAR,DOLLAR,HEADER,DIGIT,LETTER,MODATA,DASH         GLOBAL      7
      LOGICAL FATAL                                                     GLOBAL      8
      COMMON / GLOBAL / INFIL,SRCFIL,CRTFIL,OUTFIL,MACFIL,PGMFIL,       GLOBAL      9
     $                  HEADER,DOLLAR,SLASH,LPAREN,RPAREN,BLANK,AMP,E,  GLOBAL     10
     $                  DOT,DOLLAR,STAR,NULL,ZERO,ONE,TWO,THREE,SIX,    GLOBAL     11
     $                  MODATA,DASH,                                    GLOBAL     12
     $                  PARAM(10,36),NORMAN(70,10),INTYPE(70,15),       GLOBAL     13
     $                  VALID(70,20),IBERES(15),DIGIT(10),LETTER(10),   GLOBAL     14
     $                  LEVEL,NRMODS,NUMBOL,FATAL                       GLOBAL     15
C                                                                       GLOBAL     16
C  READ NEXT LINE                                                       GETLN       9
C                                                                       GETLN      10
      READ(FILE,1000) (LINE(I),I=1,80)                                  GETLN      11
      IF (LINE(1) .EQ. DOLLAR)  GO TO 900                               GETLN      12
      IF (LEVEL .GT. 3)  WRITE(6,3000) (LINE(I),I=1,80)                 GETLN      13
      IF (FILE .NE. MACFIL)  GO TO 500                                  GETLN      14
C                                                                       GETLN      15
C  EXPAND MACRO PARAMETERS                                              GETLN      16
C                                                                       GETLN      17
        IN = 1                                                          GETLN      18
        OUT = 0                                                         GETLN      19
   10   CONTINUE                                                        GETLN      20
        IF ((IN .GT. 80) .OR. (OUT .GE. 80))  GO TO 100                 GETLN      21
C          SCAN FOR AMPERSAND (SIGNALS PARAMETER)                       GETLN      22
           IF (LINE(IN) .EQ. AMP)  GO TO 50                             GETLN      23
              OUT = OUT+1                                               GETLN      24
              NLINE(OUT) = LINE(IN)                                     GETLN      25
              IN = IN+1                                                 GETLN      26
              GO TO 10                                                  GETLN      27
C             HAVE A PARAMETER                                          GETLN      28
   50         CONTINUE                                                  GETLN      29
              INP1 = IN+1                                               GETLN      30
              DO 55 I=1,10                                              GETLN      31
                 NPARAM = I                                             GETLN      32
                 IF (LINE(INP1) .EQ. LETTER(I))  GO TO 53               GETLN      33
   55         CONTINUE                                                  GETLN      34
C             UNDEFINED PARAMETER                                       GETLN      35
              CALL ERREND(6,LINE(INP1))                                 GETLN      36
   53         CONTINUE                                                  GETLN      37
              K = 1                                                     GETLN      38
C             REPLACE DUMMY PARAMETER WITH ACTUAL PARAMETER             GETLN      39
   60         CONTINUE                                                  GETLN      40
              IF ((K .GT. 30) .OR. (PARAM(NPARAM,K) .EQ. BLANK))        GETLN      41
     $           GO TO 80                                               GETLN      42
                 OUT = OUT+1                                            GETLN      43
                 NLINE(OUT) = PARAM(NPARAM,K)                           GETLN      44
                 K = K+1                                                GETLN      45
                 GO TO 60                                               GETLN      46
   80         CONTINUE                                                  GETLN      47
              IN = IN+2                                                 GETLN      48
              GO TO 10                                                  GETLN      49
  100    CONTINUE                                                       GETLN      50
C                                                                       GETLN      51
C  RETURN LINE WITH EXPANDED PARAMETERS                                 GETLN      52
C                                                                       GETLN      53
       DO 120 I=1,80                                                    GETLN      54
          LINE(I) = BLANK                                               GETLN      55
  120  CONTINUE                                                         GETLN      56
       DO 140 I=1,OUT                                                   GETLN      57
          LINE(I) = NLINE(I)                                            GETLN      58
  140  CONTINUE                                                         GETLN      59
       IF (LEVEL .GT. 3)  WRITE(6,3001) (LINE(I),I=1,80)                GETLN      60
  500  CONTINUE                                                         GETLN      61
       RETURN                                                           GETLN      62
C                                                                       GETLN      63
C  ERROR EXIT                                                           GETLN      64
C                                                                       GETLN      65
  900  CONTINUE                                                         GETLN      66
          CALL ENDFIL(FILE)                                             GETLN      67
          RETURN                                                        GETLN      68
C                                                                       GETLN      69
 1000 FORMAT(80A1)                                                      GETLN      70
 3000 FORMAT(' ',80A1)                                                  GETLN      71
 3001 FORMAT(' ',80A1)                                                  GETLN      72
```

```
C                                                                       GETLN      72
      END                                                               GETLN      74
      SUBROUTINE EXPAND (LINE,FILE)                                     EXPAND       1
C                                                                       EXPAND       2
C  EXPAND PERFORMS THE INITIALIZATIONS REQUIRED FOR THE PROCESSING      EXPAND       3
C  OF A MACRO.  IN PARTICULAR, THE MACRO NUMBER IS FOUND IN THE         EXPAND       4
C  ARRAY LINE AND THE MACRO FILE IS POSITIONED AT THE FIRST LINE OF     EXPAND       5
C  THIS RECORD.  ALSO, FILE IS CHANGED TO MACFIL SO THAT FUTURE CALLS   EXPAND       6
C  TO GETLN WILL DO MACRO PARAMETER EXPANSIONS. FINALLY, THE ACTUAL     EXPAND       7
C  PARAMETERS FOUND IN LINE ARE PLACED IN THE PARAMETER TABLE.          EXPAND       8
C                                                                       EXPAND       9
      INTEGER LINE(80),FILE,LPTR                                        EXPAND      10
C                                                                       GLOBAL       1
C  GLOBAL VARIABLES                                                     GLOBAL       2
C                                                                       GLOBAL       3
      INTEGER SCNFIL,SRCFIL,OPTFIL,OUTFIL,MACFIL,PGMFIL,PARAM,COMMA,    GLOBAL       4
     $        SLASH,LPAREN,RPAREN,BLANK,AMP,E,ZERO,ONE,TWO,THREE,SIX,   GLOBAL       5
     $        NPARAM,DNTYPE,VALID,LEVEL,DOT,NULL,NRMODS,                GLOBAL       6
     $        NUMDOL,STAR,DOLLAR,HEADER,DIGIT,LETTER,MODATA,DASH        GLOBAL       7
      LOGICAL FATAL                                                     GLOBAL       8
      COMMON / GLOBAL / SCNFIL,SRCFIL,OPTFIL,OUTFIL,MACFIL,PGMFIL,      GLOBAL       9
     $                  HEADER,COMMA,SLASH,LPAREN,RPAREN,BLANK,AMP,E,  GLOBAL      10
     $                  DOT,DOLLAR,STAR,NULL,ZERO,ONE,TWO,THREE,SIX,   GLOBAL      11
     $                  MODATA,DASH,                                   GLOBAL      12
     $                  PARAM(10,35),MDNAM(70,10),DNTYPE(70,15),       GLOBAL      13
     $                  VALID(70,30),IZERO8(16),DIGIT(10),LETTER(10),  GLOBAL      14
     $                  LEVEL,NRMODS,NUMDOL,FATAL                      GLOBAL      15
C                                                                       GLOBAL      16
C  PICK UP MACRO NUMBER                                                 EXPAND      11
C                                                                       EXPAND      12
      LPTR = 8                                                          EXPAND      13
      MACNO = NUMBER(LINE,LPTR)                                         EXPAND      14
      IF (LEVEL .GT. 1)  WRITE(6,3000) MACNO                            EXPAND      15
C                                                                       EXPAND      16
C  ASSEMBLE TABLE OF ACTUAL PARAMETERS                                  EXPAND      17
C                                                                       EXPAND      18
C     FIRST BLANK OUT THE PARAMETER TABLE                               EXPAND      19
      DO 5 I=1,10                                                       EXPAND      20
         DO 5 J=1,30                                                    EXPAND      21
            PARAM(I,J) = BLANK                                          EXPAND      22
    5 CONTINUE                                                          EXPAND      23
      NCH = 0                                                           EXPAND      24
      NPARAM = 1                                                        EXPAND      25
   10 CONTINUE                                                          EXPAND      26
C     CHECK FOR END OF LAST PARAMETER                                   EXPAND      27
      IF (LINE(LPTR) .EQ. SLASH)  GO TO 50                              EXPAND      28
C        CHECK FOR END OF CURRENT PARAMETER                             EXPAND      29
         IF (LINE(LPTR) .EQ. COMMA)  GO TO 40                           EXPAND      30
            NCH = NCH+1                                                 EXPAND      31
            PARAM(NPARAM,NCH) = LINE(LPTR)                              EXPAND      32
            LPTR = LPTR+1                                               EXPAND      33
            GO TO 10                                                    EXPAND      34
   40    CONTINUE                                                       EXPAND      35
         NPARAM = NPARAM+1                                              EXPAND      36
         NCH = 0                                                        EXPAND      37
         LPTR = LPTR+1                                                  EXPAND      38
         GO TO 10                                                       EXPAND      39
   50 CONTINUE                                                          EXPAND      40
      IF (LEVEL .GT. 1)  WRITE(6,3001) NPARAM,((PARAM(I,J),             EXPAND      41
     $                                   J=1,30),I=1,NPARAM)            EXPAND      42
C                                                                       EXPAND      43
C  SKIP RECORDS TO MACRO                                                EXPAND      44
C                                                                       EXPAND      45
      FILE=MACFIL                                                       EXPAND      46
      REWIND MACFIL                                                     EXPAND      47
      CALL SKPREC(MACNO,MACFIL)                                         EXPAND      48
C                                                                       EXPAND      49
C  VALIDATE MACRO NUMBER                                                EXPAND      50
C                                                                       EXPAND      51
      READ(MACFIL,3002)MACHEK                                           EXPAND      52
      IF (MACNO .NE. MACHEK) CALL ERREND(3,FILE)                        EXPAND      53
C                                                                       EXPAND      54
C  READ FIRST LINE OF MACRO                                             EXPAND      55
C                                                                       EXPAND      56
      CALL  GTLN(FILE,LINE)                                             EXPAND      57
      RETURN                                                            EXPAND      58
```

```
C                                                                       EXPAND     69
 3000 FORMAT(7X,17H EXPANDING MACRO ,I5)                                EXPAND     61
 3001 FORMAT(7X,22H NUMBER OF PARAMETERS=,I2,5X,9HTHEY ARE/             EXPAND     62
     $       (12X,20A1))                                               EXPAND     63
 3002 FORMAT(/TO,I3/)                                                   EXPAND     64
C                                                                       EXPAND     65
      END                                                               EXPAND     66
      SUBROUTINE COPYRC (IFILE,OFILE,PUTC,ENDC,LINE,NEEDLN)             COPYRC      1
C                                                                       COPYRC      2
C  COPYRC MOVES CARDS FROM FILE IFILE TO FILE OFILE UNTIL THE           COPYRC      3
C  CHARACTER ENDC IS FOUND IN COLUMN 1. ON OUTPUT THE COLUMN 1          COPYRC      4
C  CHARACTER IS REPLACED BY THE CHARACTER PUTC.  IF NEEDLN IS           COPYRC      5
C  FALSE THE FIRST LINE TO BE COPIED ALREADY RESIDES IN THE             COPYRC      6
C  ARRAY LINE.                                                          COPYRC      7
C                                                                       COPYRC      8
      INTEGER IFILE,OFILE,LINE(80),PUTC,ENDC                            COPYRC      9
      LOGICAL NEEDLN                                                    COPYRC     10
C                                                                       GLOBAL      1
C  GLOBAL VARIABLES                                                     GLOBAL      2
C                                                                       GLOBAL      3
      INTEGER CONFIL,GRDFIL,OPTFIL,OUTFIL,MACFIL,PGMFIL,PARAM,COMMA,    GLOBAL      4
     $        SLASH,LPAREN,RPAREN,BLANK,AMP,E,ZERO,ONE,TWO,THREE,SIX,   GLOBAL      5
     $        MODNAM,DMTYPE,VALID,LEVEL,DOT,NULL,NRMODS,                GLOBAL      6
     $        NUDCOL,STAR,DOLLAR,HEADER,DIGIT,LETTER,NODATA,DASH        GLOBAL      7
      LOGICAL FATAL                                                     GLOBAL      8
      COMMON / GLOBAL / CONFIL,GRDFIL,OPTFIL,OUTFIL,MACFIL,PGMFIL,      GLOBAL      9
     $                  HEADER,COMMA,SLASH,LPAREN,RPAREN,BLANK,AMP,E,  GLOBAL     10
     $                  DOT,DOLLAR,STAR,NULL,ZERO,ONE,TWO,THREE,SIX,   GLOBAL     11
     $                  NODATA,DASH,                                   GLOBAL     12
     $                  PARAM(10,35),MODNAM(70,10),DMTYPE(70,15),      GLOBAL     13
     $                  VALID(70,20),IZEROS(15),DIGIT(10),LETTER(10),  GLOBAL     14
     $                  LEVEL,NRMODS,NUDCOL,FATAL                      GLOBAL     15
C                                                                       GLOBAL     16
      IF (NEEDLN)  CALL GETLN(IFILE,LINE)                               COPYRC     12
   10 CONTINUE                                                          COPYRC     13
      IF (LINE(1) .EQ. ENDC)  GO TO 30                                  COPYRC     14
         IF (PUTC .NE. NULL)  LINE(1) = PUTC                            COPYRC     15
         IF (LINE(2) .NE. DOT)  GO TO 20                                COPYRC     16
            LINE(1) = DOT                                               COPYRC     17
            LINE(2) = BLANK                                             COPYRC     18
   20    CONTINUE                                                       COPYRC     19
         WRITE(OFILE,1000) (LINE(I),I=1,80)                             COPYRC     20
         CALL GETLN(IFILE,LINE)                                         COPYRC     21
         GO TO 10                                                       COPYRC     22
   30 CONTINUE                                                          COPYRC     23
      RETURN                                                            COPYRC     24
C                                                                       COPYRC     25
 1000 FORMAT(80A1)                                                      COPYRC     26
C                                                                       COPYRC     27
      END                                                               COPYRC     28
      SUBROUTINE WRTMOD (MODULE,CODE,CLEN,PTR)                          WRTMOD      1
C                                                                       WRTMOD      2
C  WRTMOD GENERATES A MODULE SEGMENT (DIS, INDEX OR SOL) WHICH INVOKES  WRTMOD      3
C  MODULE NUMBER MODULE.  THE ENCODED ELLPACK PROGRAM CODE IS CHECKED   WRTMOD      4
C  FOR THE PRESENCE OF MODULE PARAMETERS WHICH ARE ALSO WRITTEN OUT.    WRTMOD      5
C                                                                       WRTMOD      6
      INTEGER MODULE,CODE(CLEN),PTR,CLEN,PSTART,PSTOP                   WRTMOD      7
C                                                                       GLOBAL      1
C  GLOBAL VARIABLES                                                     GLOBAL      2
C                                                                       GLOBAL      3
      INTEGER CONFIL,GRDFIL,OPTFIL,OUTFIL,MACFIL,PGMFIL,PARAM,COMMA,    GLOBAL      4
     $        SLASH,LPAREN,RPAREN,BLANK,AMP,E,ZERO,ONE,TWO,THREE,SIX,   GLOBAL      5
     $        MODNAM,DMTYPE,VALID,LEVEL,DOT,NULL,NRMODS,                GLOBAL      6
     $        NUDCOL,STAR,DOLLAR,HEADER,DIGIT,LETTER,NODATA,DASH        GLOBAL      7
      LOGICAL FATAL                                                     GLOBAL      8
      COMMON / GLOBAL / CONFIL,GRDFIL,OPTFIL,OUTFIL,MACFIL,PGMFIL,      GLOBAL      9
     $                  HEADER,COMMA,SLASH,LPAREN,RPAREN,BLANK,AMP,E,  GLOBAL     10
     $                  DOT,DOLLAR,STAR,NULL,ZERO,ONE,TWO,THREE,SIX,   GLOBAL     11
     $                  NODATA,DASH,                                   GLOBAL     12
     $                  PARAM(10,35),MODNAM(70,10),DMTYPE(70,15),      GLOBAL     13
     $                  VALID(70,20),IZEROS(15),DIGIT(10),LETTER(10),  GLOBAL     14
     $                  LEVEL,NRMODS,NUDCOL,FATAL                      GLOBAL     15
C                                                                       GLOBAL     16
C  WRITE OUT MODULE NAME                                                WRTMOD      9
C                                                                       WRTMOD     10
      WRITE(PGMFIL,2000) (MODNAM(MODULE,K),K=1,10)                      WRTMOD     11
```

```
C
C  CHECK FOR MODULE PARAMETERS
C
      PSTART = PTR-1
      IF (CODE(PSTART) .NE. COMMA)  GO TO 100
C
C        PARAMETERS ARE PRESENT
C
C        FIRST FIND SLASH
         DO 10 I=PTR,4[illegible])
            PSTOP = I
            IF (CODE(I) .EQ. SLASH)  GO TO 20
   10    CONTINUE
C        PARAMETERS ARE NOW IN CODE(PSTART+1) TO CODE(PSTOP-1)
   20    CONTINUE
         PSTART = PSTART+1
         PSTOP = PSTOP-1
         IF (PSTART .GE. PSTOP)  GO TO 100
         WRITE(PCHFIL,2001) LPAREN,(CODE(I),I=PSTART,PSTOP),RPAREN
         PTR = PSTOP+2
C
  100 CONTINUE
      RETURN
C
 2000 FORMAT(1H,,14X,12A1)
 2001 FORMAT(1H,,20X,50A1)
C
      END
      SUBROUTINE COMPAT(PTYPE,DISMOD,NRTYPE,NX,NY,NZ,DISPAR,CODE,CLEN)
C
C  COMPAT USES THE PROBLEM TYPE INFO (PTYPE) AND DISCRETIZATION MODULE
C  INFO (DMTYPE) TO DETERMINE WHETHER MODULE DISMOD IS COMPATIBLE
C  WITH THE GIVEN PDE PROBLEM. THE NRTYPE (NOW 15) ITEMS IN THE ARRAY
C  PTYPE AND IN EACH ROW OF THE TABLE DMTYPE HAVE THE FOLLOWING
C  MEANINGS --
C
C          VALUE        PTYPE MEANING            DMTYPE MEANING
C         -------    --------------------    ---------------------------
C            0       ITEM NOT PRESENT        ITEM MUST NOT BE PRESENT
C            1       ALWAYS MATCHES          ALWAYS MATCHES
C            2       ITEM PRESENT            ITEM MUST BE PRESENT
C
C  THE 14 ITEMS CURRENTLY CHECKED FOR COMPATIBILITY ARE
C
C       CONCERNING THE OPERATOR
C            1      TWO DIMENSIONAL
C            2      THREE DIMENSIONAL
C            3      POISSON EQUATION
C            4      LAPLACE EQUATION
C            5      [illegible]
C            6      CONSTANT COEFFICIENTS
C            7      SELF-ADJOINT FORM
C            8      HOMOGENEOUS
C            9      [illegible]
C       CONCERNING THE BOUNDARY CONDITIONS
C           10      [illegible]
C           11      [illegible] CONDITIONS
C           12      [illegible]
C           13      [illegible]
C       CONCERNING THE GRID
C           14      [illegible]
C           15      [illegible]
C
C  OTHER CHECKING THAT IS DONE IS
C
C     1. [illegible] AND THE GRID
C        [illegible]
C     2. [illegible] MODULE WE CHECK FOR
C           A. [illegible]
C           B. [illegible] MUST BE POISSON
C           C. [illegible]
C
C
      INTEGER [illegible]
     S            [illegible]
C
```

```
C  GLOBAL VARIABLES                                                    GLOBAL     2
C                                                                      GLOBAL     3
      INTEGER INFIL, IRSTFIL, IRSTFIL, OUTFIL, MODFIL, PGMFIL, PARAM, COMMA,   GLOBAL     4
     $        [illegible] ZERO, ONE, TWO, THREE, SIX,                  GLOBAL     5
     $        [illegible] NULL, NDIGIT,                                GLOBAL     6
     $        [illegible] NUMBER, DIGIT, LETTER, NODATA, DASH          GLOBAL     7
      LOGICAL [illegible]                                              GLOBAL     8
      COMMON / GLOBAL / INFIL, IRSTFIL, IRSTFIL, OUTFIL, MODFIL, PGMFIL,   GLOBAL     9
     $                  MESSAGE, BLANK, LPAREN, RPAREN, BLANK, AMP, E,   GLOBAL    10
     $                  [illegible] NULL, ZERO, ONE, TWO, THREE, SIX,    GLOBAL    11
     $                  NDIGIT, PARAM,                                   GLOBAL    12
     $                  PARAM(10,6), NDIMAX(70,10), DNTYPE(70,15),       GLOBAL    13
     $                  VALID(70,21), IERRS(15), DIGIT(10), LETTER(10),  GLOBAL    14
     $                  LEVEL, NDMTOT, NUMCOL, FATAL                     GLOBAL    15
C                                                                      GLOBAL    16
C  CHECK IF A DISCRETIZATION MODULE IS PRESENT  --  IF NOT, WARNING     COMPAT    40
C                                                                      COMPAT    50
      IF (DISMOD .EQ. 0)  GO TO 60                                     COMPAT    51
C                                                                      COMPAT    52
C  DETERMINE WHICH ROW OF DNTYPE CONTAINS INFO ABOUT MODULE DISMOD     COMPAT    53
C                                                                      COMPAT    54
      DO 10 I=1,NUMCOL                                                 COMPAT    55
         K = I                                                         COMPAT    56
         IF (VALID(1,K) .EQ. DISMOD)  GO TO 20                         COMPAT    57
   10 CONTINUE                                                         COMPAT    58
      GO TO 310                                                        COMPAT    59
C                                                                      COMPAT    60
C  COMPARE PTYPE(.) AND DNTYPE(K,.) FOR COMPATIBILITY                  COMPAT    61
C                                                                      COMPAT    62
   20 CONTINUE                                                         COMPAT    63
      NREAD = 0                                                        COMPAT    64
      DO 50 I=1,NRTYPE                                                 COMPAT    65
         IF (PTYPE(I) .EQ. ONE)  GO TO 50                              COMPAT    66
         IF (DNTYPE(K,I) .EQ. ONE)  GO TO 50                           COMPAT    67
         IF (PTYPE(I) .EQ. DNTYPE(K,I))  GO TO 50                      COMPAT    68
            NREAD = NREAD+1                                            COMPAT    69
            INCOMP(NREAD) = I                                          COMPAT    70
   50 CONTINUE                                                         COMPAT    71
      IF (NREAD .NE. 0)  GO TO 300                                     COMPAT    72
C                                                                      COMPAT    73
C  NOW CHECK IF NON-UNIFORM GRID IS COMPATIBLE WITH PROBLEM DIMENSION   COMPAT    74
C                                                                      COMPAT    75
         IF (PTYPE(15) .EQ. ZERO)  GO TO 55                            COMPAT    76
         IF (((PTYPE(1) .EQ. TWO) .AND. (NZ .LE. 1)) .OR.              COMPAT    77
     $        ((PTYPE(2) .EQ. TWO) .AND. (NZ .GT. 1)))  GO TO 55       COMPAT    78
            FATAL = .TRUE.                                             COMPAT    79
            WRITE(PGMFIL,2013) STAR,STAR,STAR                          COMPAT    80
            WRITE(6,2013) BLANK,BLANK,BLANK                            COMPAT    81
   55    CONTINUE                                                      COMPAT    82
C                                                                      COMPAT    83
C----------------------------------------------------------------------COMPAT    84
C                                                                      COMPAT    85
C  THE FOLLOWING ARE SPECIAL CHECKS FOR PARTICULAR MODULES             COMPAT    86
C                                                                      COMPAT    87
C    --- THIS SECTION OF CODE MUST BE CHANGED WHEN MODULES ---         COMPAT    88
C    --- ARE RENUMBERED.                                  ---         COMPAT    89
C                                                                      COMPAT    90
C                                                                      COMPAT    91
C  CHECK FFT 9-POINT                                                   COMPAT    92
C                                                                      COMPAT    93
      IF (DISMOD .NE. 8)  GO TO 110                                    COMPAT    94
         IF (VALID(NDMAX-1) .NE. DISMOD)  GO TO 330                    COMPAT    95
         IORDER = [illegible]                                          COMPAT    96
         IF ([illegible] .EQ. 3) .AND. (PTYPE(3) .NE. TWO))  GO TO 330 COMPAT    97
         IF ([illegible] .NE. 0)  GO TO 310                            COMPAT    98
  110 CONTINUE                                                         COMPAT    99
C                                                                      COMPAT   100
C----------------------------------------------------------------------COMPAT   101
C                                                                      COMPAT   102
C                                                                      COMPAT   103
C  NORMAL EXIT  ---  MODULE COMPATIBLE WITH PROBLEM                    COMPAT   104
C                                                                      COMPAT   105
      [illegible]                                                      COMPAT   106
      [illegible]                                                      COMPAT   107
C                                                                      COMPAT   108
C  ERROR EXIT                                                          COMPAT   109
```

```
C
C
C     MODULE INCOMPATIBLE WITH PROBLEM
  500 CONTINUE
      FATAL = .TRUE.
      WRITE(ECHFIL,2001) STAR,STAR,STAR,(INCOMP(I),I=1,NRBAD)
      WRITE(6,2001) BLANK,BLANK,BLANK,(INCOMP(I),I=1,NRBAD)
      GO TO 900
C
C     MODULE NOT A DISCRETIZATION MODULE
  510 CONTINUE
      FATAL = .TRUE.
      WRITE(ECHFIL,2002) STAR,STAR,STAR,DISMOD
      WRITE(6,2002) BLANK,BLANK,BLANK,DISMOD
      GO TO 900
C
C     FFT 9-POINT PROBLEMS
  520 CONTINUE
      FATAL = .TRUE.
      WRITE(ECHFIL,2003) STAR,STAR,STAR
      WRITE(6,2003) BLANK,BLANK,BLANK
      GO TO 900
  530 CONTINUE
      FATAL = .TRUE.
      WRITE(ECHFIL,2004) STAR,STAR,STAR
      WRITE(6,2004) BLANK,BLANK,BLANK
      GO TO 900
  540 CONTINUE
      FATAL = .TRUE.
      WRITE(ECHFIL,2005) STAR,STAR,STAR
      WRITE(6,2005) BLANK,BLANK,BLANK
      GO TO 900
C
C     NO DISCRETIZATION MODULE PRESENT  -- PRINT WARNING
  800 CONTINUE
      WRITE(ECHFIL,2007) STAR,STAR,STAR
      WRITE(6,2007) BLANK,BLANK,BLANK
C
  900 CONTINUE
      RETURN
C
 2000 FORMAT(1H0 / 41H0        PROBLEM/DIS MODULE ARE COMPATIBLE  )
 2001 FORMAT(A1/A1,40H------ ERROR IN ENCODED PROGRAM
     S       /A1,47H        PROBLEM/DIS MODULE INCOMPATIBLE IN ITEMS
     S       ,20I3)
 2002 FORMAT(A1/A1,40H------ ERROR IN ENCODED PROGRAM
     S       /A1,7X,6HMODULE,I3,21H IS NOT A DISCRETIZATION MODULE)
 2003 FORMAT(A1/A1,40H------ ERROR IN ENCODED PROGRAM
     S              /A1,47H        FFT 9-POINT MUST HAVE A PARAMETER   )
 2004 FORMAT(A1/A1,40H------ ERROR IN ENCODED PROGRAM
     S              /A1,50H        FFT 9-POINT MUST HAVE POISSON EQN
     S              ,47H WHEN ORDER=6                          )
 2005 FORMAT(A1/A1,40H------ ERROR IN ENCODED PROGRAM
     S              /A1,47H        FFT 9-POINT MUST HAVE GRID OF SIZ
     S              ,41HE (2**N)-1                             )
 2007 FORMAT(A1/A1,40H------ WARNING
     S              /A1,48H        NO DISCRETIZATION PRESENT          )
 2010 FORMAT(A1/A1,33H------ ERROR IN INPUT
     S              /A1,46H        GRID DOES NOT MATCH PROBLEM DIMENSION )
C
      END
      SUBROUTINE LEGAL (DISMOD,INDMOD,SOLMOD)
C
C  LEGAL DETERMINES WHETHER THE SEQUENCE OF MODULES (DISMOD,INDMOD,
C  SOLMOD) IS LEGAL, I.E. WHETHER THESE MODULES ARE COMPATIBLE.
C  THE SET OF ALL LEGAL SEQUENCES IS REPRESENTED BY THE CONNECTION
C  TABLE VALID.  MODULE J MAY FOLLOW MODULE I IF AND ONLY IF J
C  APPEARS IN ROW I+1 OF THE ARRAY VALID. THE LAST ENTRY IN EACH
C  [illegible] CONTAINS THE INDICES OF THOSE MODULES WHICH
C  [illegible] BY NO OTHERS.
C
      [illegible] INDMOD,SOLMOD,MODULE(4),SEQLEN
      [illegible]
C
C  [illegible] VALID
C
```

```
      INTEGER CONFIL,ERRFIL,SRTFIL,OUTFIL,MACFIL,PGMFIL,PARAM,COMMA,
     $        SLASH,LPAREN,RPAREN,BLANK,AMP,E,ZERO,ONE,TWO,THREE,SIX,
     $        NINE,STAR,DOLLAR,MINUS,DIGIT,LETTER,MDATA,BACH
      LOGICAL FATAL
      COMMON / CLOCOL / CONFIL,ERRFIL,SRTFIL,OUTFIL,MACFIL,PGMFIL,
     $                  MINUS,COMMA,SLASH,LPAREN,RPAREN,BLANK,AMP,E,
     $                  DOT,DOLLAR,STAR,NULL,ZERO,ONE,TWO,THREE,SIX,
     $                  MDATA,BACH,
     $                  PARAM(10,35),MODNAM(70,10),ONTYPE(70,15),
     $                  VALID(70,80),ZEROS(15),DIGIT(10),LETTER(10),
     $                  LEVEL,NRMODS,MJCOL,FATAL
C
C  COLLECT MODULE SEQUENCE IN VECTOR MODULE
C
      SEQLEN = 1
      MODULE(1) = 0
      IF (DISMOD .EQ. 0)  GO TO 10
         SEQLEN = SEQLEN+1
         MODULE(SEQLEN) = DISMOD
   10 CONTINUE
      IF (INSMOD .EQ. 0)  GO TO 20
         SEQLEN = SEQLEN+1
         MODULE(SEQLEN) = INSMOD
   20 CONTINUE
      IF (SOLMOD .EQ. 0)  GO TO 30
         SEQLEN = SEQLEN+1
         MODULE(SEQLEN) = SOLMOD
   30 CONTINUE
C
C  CHECK FOR LEGALITY
C
      IF (SEQLEN .EQ. 1)  GO TO 210
      NREMT = SEQLEN-1
      DO 50 K=1,NREMT
C        CHECK IF MODULE(K+1) MAY FOLLOW MODULE(K)
         NEXT = MODULE(K+1)
         NOW = MODULE(K)+1
         IF (LEVEL .GT. 3)  WRITE(6,2000) MODULE(K),(VALID(NOW,II),
     $                                     II=1,30),NEXT
         FOUND = .FALSE.
         I = 1
   40    CONTINUE
C        SEARCH FOR VALUE NEXT IN ROW NOW OF VALID
         IF (VALID(NOW,I) .EQ. 0)  GO TO 45
             IF (VALID(NOW,I) .EQ. NEXT)  FOUND = .TRUE.
             I = I+1
             GO TO 40
   45    CONTINUE
         IF (.NOT. FOUND)  GO TO 220
   50 CONTINUE
      N = MODULE(SEQLEN)+1
      IF (VALID(N,1) .NE. 0)  GO TO 230
C
C  NORMAL EXIT  --  EXECUTION SEQUENCE LEGAL
C
      WRITE(PGMFIL,2000)
      GO TO 300
C
C  ABNORMAL EXIT  --  EXECUTION SEQUENCE ILLEGAL
C
  210 CONTINUE
      WRITE(ERRFIL,2001) STAR,STAR,STAR
      WRITE(6,2001) BLANK,BLANK,BLANK
      GO TO 300
  220 CONTINUE
      FATAL = .TRUE.
      WRITE(ERRFIL,2002) STAR,STAR,STAR
      WRITE(6,2002) BLANK,BLANK,BLANK
C
  300 CONTINUE
      RETURN
C
 2000 FORMAT(1H*,60H       MODULE SEQUENCE IS LEGAL)
 2001 FORMAT(1H0,3A1,60H------ WARNING ------                  /
     $       1H ,3A1,60H       MODULE SEQUENCE IS NULL    )
```

```
2002 FORMAT([illegible]------ [illegible]
     $ [illegible]
2000 FORMAT([illegible] YOU ENTER = ,
     $ [illegible]
C
      END
      SUBROUTINE [illegible]
C
C  [illegible] ERRORS [illegible]
C  [illegible]
C  [illegible]
C  IS TURNED ON.
C
C
C  GLOBAL VARIABLES
C
      INTEGER [illegible],COMMA,
     $        [illegible]
     $        [illegible]
     $        [illegible],EACH
      LOGICAL [illegible]
      COMMON /GLOBAL/ [illegible]
     $                [illegible]
     $                [illegible]
     $                [illegible]
     $                [illegible]
     $                [illegible]
     $                [illegible]
C
      INTEGER ERRNUM,IPAR
C
      CALL [illegible](1)
      CALL [illegible]('[illegible]******************************      ')
      CALL [illegible]('[illegible]ERROR-IN-[illegible]-[illegible]-PROGRAM   ')
      CALL [illegible]('[illegible]******************************      ')
      WRITE(6,[illegible])
      END FILE [illegible]
C
      GO TO (10,20,30,40,50,60,70,80,90,100,110,120,130),ERRNUM
C
   10 CONTINUE
      STOP
   20 CONTINUE
      WRITE(6,[illegible]) IPAR
      [illegible]
   30 CONTINUE
      WRITE(6,[illegible]) IPAR
      [illegible]
   40 [illegible]
      [illegible] IPAR
      [illegible]
   50 [illegible]
      [illegible] IPAR
   60 [illegible]
      [illegible]
   70 [illegible]
      [illegible]
   80 [illegible]
      [illegible]
   90 [illegible]
      [illegible]
  100 [illegible]
      [illegible]
  110 [illegible]
      [illegible]
  120 [illegible]
      [illegible]
  130 [illegible]
```

```
      WRITE(6,2130)                                                    ERREND     56
      STOP                                                             ERREND     57
C                                                                      ERREND     58
 2000 FORMAT(//1X,44H****** FATAL ERROR PREVENTS ELLPACK PROGRAM ,      ERREND     59
     $       10HGENERATION   )                                         ERREND     60
 2020 FORMAT(8X,10HCHARACTER ,A1,28H APPEARS IN ENCODED PROGRAM ,       ERREND     61
     $       24HWHERE DIGIT IS EXPECTED  )                             ERREND     62
 2030 FORMAT(8X,35HUNEXPECTED END ENCOUNTERED ON FILE ,I3)              ERREND     63
 2040 FORMAT(8X,10HCHARACTER ,A1,28H APPEARS IN PROBLEM TYPE FIE,       ERREND     64
     $       48HLD OF PROBLEM RECORD WHERE ONLY 0,1,2 ARE LEGAL  )     ERREND     65
 2050 FORMAT(8X,42HINVALID PROBLEM NUMBER SPECIFIED FOR FILE ,I3)       ERREND     66
 2060 FORMAT(8X,25HINVALID PARAMETER NAME = ,A1)                        ERREND     67
 2070 FORMAT(8X,48HINVALID PARAMETER SET NUMBER SPECIFIED FOR FILE ,I3) ERREND     68
 2080 FORMAT(8X,40HINVALID MACRO NUMBER SPECIFIED FOR FILE ,I3)         ERREND     69
 2090 FORMAT(8X,42HINVALID OPTIONS NUMBER SPECIFIED FOR FILE ,I3)       ERREND     70
 2100 FORMAT(8X,39HINVALID GRID NUMBER SPECIFIED FOR FILE ,I3)          ERREND     71
 2110 FORMAT(8X,49HINVALID OUTPUT SEGMENT NUMBER SPECIFIED FOR FILE ,I3)ERREND     72
 2120 FORMAT(8X,41HINVALID RECORD NUMBER SPECIFIED FOR FILE ,I3)        ERREND     73
 2130 FORMAT(8X,48HNO PROBLEM NUMBERED SPECIFIED IN ENCODED PROGRAM)    ERREND     74
C                                                                      ERREND     75
      END                                                              ERREND     76
*PREFIX,$                                                              SKIP       1
          IDENT  SKIP                                                  SKIP       2
*                                                                      SKIP       3
*         AUTHOR:  JOHN F. BROPHY                                      SKIP       4
*                  DEPARTMENT OF MATHEMATICS                           SKIP       5
*                  PURDUE UNIVERSITY                                   SKIP       6
*                  NOVEMBER 1, 1979                                    SKIP       7
*                                                                      SKIP       8
*            THIS CDC ASSEMBLY LANGUAGE (COMPASS) ROUTINE PROVIDES FOR SKIP       9
*         AUTOMATIC SKIPPING OF FILES AND RECORDS. THE CALLING SEQUENCESSKIP      10
*         ARE GIVEN BY:                                                SKIP      11
*                                                                      SKIP      12
*            CALL SKIPF(NSKIPS,FILE),  OR  SKIPR(NSKIPS,FILE)          SKIP      13
*                                                                      SKIP      14
*         WHERE NSKIPS IS THE NUMBER OF FILES OR RECORDS RESPECTIVELY  SKIP      15
*         TO BE SKIPPED IN FILE.  SEE THE DISCUSSION OF SKIPPING FILES SKIP      16
*         AND RECORDS IN THE COMMENTS IN GENPGM.                       SKIP      17
*                                                                      SKIP      18
          ENTRY  SKIPR,SKIPF                                           SKIP      19
 SKIPR    PS                                                           SKIP      20
          SB2    -B2                                                   SKIP      21
          RJ     =XGETBA                                               SKIP      22
          SA1    B1                                                    SKIP      23
          ZR     X1,RDR                                                SKIP      24
          SKIPF  X2,X1,R                                               SKIP      25
 RDR      READ   X2,R                                                  SKIP      26
          EQ     SKIPR                                                 SKIP      27
 SKIPF    PS                                                           SKIP      28
          SB2    -B2                                                   SKIP      29
          RJ     =XGETBA                                               SKIP      30
          SA1    B1                                                    SKIP      31
          ZR     X1,PDF                                                SKIP      32
          SKIPFF X2,X1,R                                               SKIP      33
 PDF      READ   X2,R                                                  SKIP      34
          EQ     SKIPF                                                 SKIP      35
          END                                                          SKIP      36
*                                                                      SKIP      37
*            THE FOLLOWING FORTRAN ROUTINES ARE PROVIDED AS SUBSTITUES SKIP      38
*         FOR THE COMPASS ROUTINE SKIP FOR INSTALLATIONS WHERE AUTOMATICSKIP      39
*         FILE AND RECORD SKIPPING CANNOT BE IMPLEMENTED.              SKIP      40
*                                                                      SKIP      41
*      SUBROUTINE SKIPF(NSKIPS,FILE)                                   SKIP      42
*C                                                                     SKIP      43
*C        THIS ROUTINE SKIPS NSKIPS FILES IN FILE BY SCANNING FOR THE  SKIP      44
*C     END-OF-FILE MARKER 'EOF' IN A4 FORMAT STARTING IN COLUMN 1.     SKIP      45
*C                                                                     SKIP      46
*      INTEGER FILE,EOF,EOFCHEK                                        SKIP      47
*      DATA EOF/4H'EOF/                                                SKIP      48
*      NSKIPED=0                                                       SKIP      49
*C                                                                     SKIP      50
*100   READ(FILE,300)EOFCHEK                                          SKIP      51
*C                                                                     SKIP      52
*      IF (EOFCHEK .EQ. 4H$   ) CALL ERREND(5,FILE)                    SKIP      53
*      IF (EOFCHEK .NE. EOF) GO TO 100                                 SKIP      54
*      NSKIPED=NSKIPED+1                                               SKIP      55
```

```
*       IF (NSKIPED .LT. NSKIPS) GO TO 100                              SKIP        56
*       RETURN                                                          SKIP        57
*C                                                                      SKIP        58
*300    FORMAT(A4)                                                      SKIP        59
*C                                                                      SKIP        60
*       END                                                             SKIP        61
*       SUBROUTINE SKIPR(NSKIPS,FILE)                                   SKIP        62
*C                                                                      SKIP        63
*C         THIS ROUTINE SKIPS NSKIPS RECORDS IN FILE BY SCANNING FOR THE SKIP        64
*C      END-OR-RECORD MARKER 'EOR IN A4 FORMAT STARTING IN COLUMN 1.    SKIP        65
*C                                                                      SKIP        66
*       INTEGER FILE,EOR,EORCHEK,EOF,EQNFIL                             SKIP        67
*       DATA EOR,EOF,EQNFIL/4H'EOR, 4H'EOF,1/                           SKIP        68
*C                                                                      SKIP        69
*       NSKIPED=0                                                       SKIP        70
*       NNSKIPS=NSKIPS                                                  SKIP        71
*       IF (FILE .EQ. EQNFIL) NNSKIPS=NNSKIPS+1                         SKIP        72
*C                                                                      SKIP        73
*100    READ(FILE,300)EORCHEK                                           SKIP        74
*C                                                                      SKIP        75
*       IF (EORCHEK .EQ. 4H$   ) CALL ERREND(12,FILE)                   SKIP        76
*       IF (EORCHEK .EQ. EOF) CALL ERREND(12,FILE)                      SKIP        77
*       IF (EORCHEK .NE. EOR) GO TO 100                                 SKIP        78
*       NSKIPED=NSKIPED+1                                               SKIP        79
*       IF (NSKIPED .LT. NNSKIPS) GO TO 100                             SKIP        80
*       RETURN                                                          SKIP        81
*C                                                                      SKIP        82
*300    FORMAT(A4)                                                      SKIP        83
*C                                                                      SKIP        84
*       END                                                             SKIP        85
```

ELLPACK PDE POPULATION EQUATION FILE

EQNFIL

EQNFIL CONTAINS THE INFORMATION NEEDED TO GENERATE THE EQUATION, BOUNDARY AND FORTRAN SEGMENTS OF AN ELLPACK PROGRAM.

EQNFIL IS DIVIDED UP INTO (SUB) FILES WHICH ARE IN TURN DIVIDED UP INTO RECORDS. THE FILES ARE NUMBERED 0, 1, 2,...ETC. AND THE RECORDS WITHIN EACH FILE ARE SIMILARLY NUMBERED 0, 1, 2,...ETC. THE END-OF-FILE AND END-OF-RECORD ARE DESIGNATED BY #EOF AND #EOR RESPECTIVELY ('EOF AND 'EOF RESPECTIVELY ON NON-CDC INSTALLATIONS).

FILE 0 CONTAINS A DESCRIPTION OF THE PURPOSE AND ORGANIZATION OF EQNFIL. FILES 1, 2, 3,... CONTAIN THE INFORMATION NEEDED TO GENERATE THE ELLPACK PROGRAM CORRESPONDING TO PROBLEMS 1, 2, 3,... RESPECTIVELY OF THE ELLPACK PDE POPULATION. AS MENTIONED ABOVE, THE FILES ARE DIVIDED INTO RECORDS WHICH HAVE THE FOLLOWING FORMAT:

RECORD 0 CONTAINS THE ELLPACK PDE POPULATION PROBLEM NUMBER. RECORDS 1, 2,... MAY TAKE ONE OF THE FOLLOWING FORMATS:

ALTERNATIVE 1:

LINE 1: LINE 1 IS EITHER BLANK OR CONTAINS DESCRIPTIVE INFORMATION SOME OF WHICH BECOMES A COMMENT IN THE GENERATED ELLPACK PROGRAM. IF NON-BLANK, LINE 1 CONTAINS THE PARAMETER SET NUMBER IN I3 FORMAT STARTING IN COLUMN 16, FOLLOWED BY THE PARAMETERS OF THE PROBLEM IN FREE FORMAT STARTING IN COLUMN 19.

LINE 2: LINE 2 CONTAINS THE COMPLEXITY MEASURES OF VARIOUS PROBLEM FEATURES IN FREE FORMAT STARTING IN COLUMN 11. THIS INFORMATATION BECOMES A COMMENT IN THE GENERATED ELLPACK PROGRAM.

LINE 3: LINE 3 CONTAINS THE PROBLEM TYPE INFORMATION STARTING IN COLUMN 11 WHICH IS USED TO TEST THE COMPATIBILIY OF THE PROBLEM WITH THE ELLPACK ROUTINES SELECTED IN THE ENCODED PROGRAM (SEE ROUTINE COMPAT). THIS INFORMATION BECOMES A COMMENT IN THE GENERATED ELLPACK PROGRAM.

COMPAT USES THE PROBLEM TYPE INFO (PTYPE) AND DISRETIZATION MODULE INFO (DMTYPE) TO DETERMINE WHETHER MODULE DISMOD IS COMPATIBLE WITH THE GIVEN PDE PROBLEM. THE NRTYPE (NOW 15) ITEMS IN THE ARRAY PTYPE AND IN EACH ROW OF THE TABLE DMTYPE HAVE THE FOLLOWING MEANINGS:

VALUE	PTYPE MEANING	DMTYPE MEANING
0	ITEM NOT PRESENT	ITEM MUST NOT BE PRESENT
1	ALWAYS MATCHES	ALWAYS MATCHES
2	ITEM PRESENT	ITEM MUST BE PRESENT

THE 14 ITEMS CURRENTLY CHECKED FOR COMPATIBILITY ARE:

CONCERNING THE OPERATOR

1. TWO DIMENSIONAL
2. THREE DIMENSIONAL
3. POISSON EQUATION
4. LAPLACE EQUATION
5. UX OR UY TERMS
6. CONSTANT COEFFICIENTS
7. SELF-ADJOINT FORM
8. HOMOGENEOUS

```
          9     UXY TERM

      CONCERNING THE BOUNDARY CONDITIONS
         10     DIRICHLET PROBLEM
         11     SOME NORMAL DERIVATIVE CONDITIONS
         12     SOME MIXED CONDITIONS
         13     HOMOGENEOUS

      CONCERNING THE GRID
         14     HX=HY(=HZ)
         15     UNIFORM GRID

   REMAINING LINES:  THE REMAINING LINES OF THE RECORD CONTAIN
   INFORMATION COPIED INTO THE EQUATION, BOUNDARY AND FORTRAN SEG-
   MENTS OF THE GENERATED ELLPACK PROGRAM IN THE ABOVE ORDER.
   THE EQUATION, BOUNDARY AND FORTRAN CARDS ARE MARKED BY A 1, 2,
   OR 3 IN COLUMN 1 RESPECTIVELY.  NOTE THAT FORTRAN CODE SHOULD
   BEGIN IN COLUMN 7 AS USUAL AND THAT A FORTRAN COMMENT CAN BE
   WRITTEN BY TYPING A C IN COLUMN 2.  FOR PORTABILITY PURPOSES,
   THE END-OF-RECORD IS DETECTED BY THE PRESENCE OF A '-' (DASH)
   IN COLUMN 1.

   ALTERNATIVE 2:
   --------------

   LINE 1:  LINE 1 CONTAINS THE PARAMETER SET NUMBER IN I3 FORMAT
   STARTING IN COLUMN 16, FOLLOWED BY THE PARAMETERS OF THE PRO-
   BLEM IN FREE FORMAT STARTING IN COLUMN 19.

   LINE 2:  LINE 2 CONTAINS THE COMPLEXITY MEASURES OF VARIOUS
   PROBLEM FEATURES IN FREE FORMAT STARTING IN COLUMN 11.  THIS
   INFORMATION BECOMES A COMMENT IN THE GENERATED ELLPACK PRO-
   GRAM.

   LINE 3:  LINE 3 IS OF THE FORM EXPAND N/N1,N2,...,NK/ STARTING
   IN COLUMN 1.  THIS SPECIFIES THAT MACRO N (THE NTH RECORD IN
   MACFIL) SHOULD BE EXPANDED WITH ACTUAL PARAMETERS N1,N2,...,NK
   REPLACING THE DUMMIES &A,&B,&C,...ETC.  THE PARAMETERS MAY
   CONTAIN ANY CHARACTERS EXCEPT A BLANK, COMMA OR SLASH AND
   MAY BE NO LONGER THAN 30 CHARACTERS.

RELATED FILES:  GENPGM, MACFIL, OPTFIL, GRDFIL, OUTFIL AND MODATA
```

```
'EOR
'EOF
***************
* PROBLEM   1 *
***************
'EOR
*PARAMETER SET   1(A=0.0)
*         000.04    006.05    000.00    006.05
*         2000002002002
1         TWO DIMENSIONS $ SELF-ADJOINT
1         EXP(X*Y)UXX$ + EXP(-X*Y)UYY$ - 1./(1.+X+Y)U$ = F(X,Y)
2         DIRICHLET $ HOMOGENEOUS
2         X=0. , U=0.
2         X=1. , U=0.
2         Y=0. , U=0.
2         Y=1. , U=0.
3     FUNCTION F(X,Y)
3     COMMON /CONCOM/ PI
3     DATA PI/3.14159265358979/
3     PX = PI*X
3     PY = PI*Y
3     SPX = SIN(PX)
3     SPY = SIN(PY)
3     EXY = EXP(X*Y)
3     F = .75*(EXY*EXY*SPY*((2.*Y*Y-PI*PI)*SPX+3.*PI*Y*COS(PX))
3    $  + PI*SPX*(2.*COS(PY)-PI*SPY)-EXY*SPX*SPY*(1.+X*Y))
3     RETURN
3     END
3     FUNCTION TRUE(X,Y)
3     COMMON /CONCOM/ PI
3     TRUE = .75*EXP(X*Y)*SIN(PI*X)*SIN(PI*Y)
3     RETURN
```

```
3      END
3      FUNCTION CDXU(X,Y)
3      CDXU = Y*EXP(X*Y)
3      RETURN
3      END
3      FUNCTION CDYU(X,Y)
3      CDYU = -X*EXP(-X*Y)
3      RETURN
3      END
-
'EOR
*PARAMETER SET   2(A=0.1)
*          000.04    006.05    000.00    006.05
EXPAND 1/0.1/
'EOR
*PARAMETER SET   3(A=1.0)
*          000.04    006.05    000.00    006.05
EXPAND 1/1.0/
'EOR
*PARAMETER SET   4(A=10.)
*          000.04    006.05    000.00    006.05
EXPAND 1/10./
-------------------------------------------------------------------------------
'EOR
'EOF
***************
* PROBLEM   2 *
***************
'EOR
*
*          000.04    000.00    004.05    010.02
*          2000200000020
1          TWO DIMENSIONS
1          UXX$ + (1.+Y*Y)UYY$ - UX$ - (1.+Y*Y)UY$ = F(X,Y)
2          MIXED
2          X=0. , MIXED = (1.)U + ( 1.)UX  =  0.27*EXP(Y)
2          X=1. , MIXED = (1.)U + (-1.)UX  =  0.
2          Y=0. , MIXED = (1.)U + ( 1.)UY  =  0.27*EXP(X)
2          Y=1. , MIXED = (1.)U + (-1.)UY  =  0.135*(ALOG(2.)-1.)*(X*X-X)**2
3      FUNCTION TRUE(X,Y)
3      TRUE = 0.135*(EXP(X+Y)+(X*X-X)**2*ALOG(1.+Y*Y))
3      RETURN
3      END
3      FUNCTION F(X,Y)
3      F = 0.135*( (-4.*X*X*X+18.*X*X-14.*X+2.)*ALOG(1.+Y*Y)
3     $    - 2.*((X*X-X)**2)*(Y*Y+Y**3+Y-1.)/(1.+Y*Y) )
3      RETURN
3      END
-------------------------------------------------------------------------------
'EOR
'EOF
***************
* PROBLEM   3 *
***************
'EOR
*PARAMETER SET   1(A=1.5)
*          000.43    090.60    000.00    070.40
EXPAND 3/1.5/
'EOR
*PARAMETER SET   2(A=2.5)
*          000.33    080.50    000.00    060.20
EXPAND 3/2.5/
'EOR
*PARAMETER SET   3(A=3.5)
*          000.23    070.30    000.00    050.15
EXPAND 3/3.5/
'EOR
*PARAMETER SET   4(A=4.5)
*          000.23    055.20    000.00    040.20
EXPAND 3/4.5/
-------------------------------------------------------------------------------
'EOR
'EOF
***************
* PROBLEM   4 *
***************
```

```
'EOR
*PARAMETER SET   1(A=0.0)
*          000.02    004.00    000.00    006.00
*          2020021002002
1          TWO DIMENSIONS $ CONSTANT COEFFICIENTS $ POISSON
1          UXXS + UYYS = 6.*X*Y*EXP(X+Y)*(X*Y+X+Y-3.)
2          DIRICHLET $ HOMOGENEOUS
2          X=0. , U=0.
2          X=1. , U=0.
2          Y=0. , U=0.
2          Y=1. , U=0.
3      FUNCTION TRUE(X,Y)
3      TRUE = 3.*EXP(X+Y)*X*Y*(1.-X)*(1.-Y)
3      RETURN
3      END
-
'EOR
*PARAMETER SET   2(A=0.1)
*          000.02    004.00    000.00    006.00
EXPAND 4/0.1/
'EOR
*PARAMETER SET   3(A=1.0)
*          000.02    004.00    000.00    006.00
EXPAND 4/1.0/
'EOR
*PARAMETER SET   4(A=10.)
*          000.02    004.00    000.00    006.00
EXPAND 4/10./
```

```
'EOR
'EOF
***************
* PROBLEM   5 *
***************
'EOR
*PARAMETER SET   1(A=0.0)
*          000.01    002.00    000.00    006.00
EXPAND 5/0./
'EOR
*PARAMETER SET   2(A=5.0)
*          000.01    002.00    000.00    006.00
EXPAND 5/5./
'EOR
*PARAMETER SET   3(A=8.0)
*          000.01    002.00    000.00    006.00
EXPAND 5/8./
'EOR
*PARAMETER SET   4(A=10.0)
*          000.03    010.00    000.00    006.00
EXPAND 5/10./
'EOR
*PARAMETER SET   5(A=20.0)
*          000.04    015.00    000.00    006.05
EXPAND 5/20./
'EOR
*PARAMETER SET   6(A=54.0)
*          000.06    030.00    000.00    008.00
EXPAND 5 54./
'EOR
*PARAMETER SET   7(A=100.0)
*          000.08    040.00    000.00    006.00
EXPAND 5 100.
```

```
'EOR
'EOF
***************
* PROBLEM   6 *
***************
'EOF'
-
*          003.16    040.20    000.00    008.30
*          2020021002002
1          TWO DIMENSIONS
1          UXXS + UYYS - COEFU(X,Y)US = F(X,Y)
2          DIRICHLET $ HOMOGENEOUS
2          X=0. , U=0.
```

```
2          X=1. , U=0.
2          Y=0. , U=0.
2          Y=1. , U=0.
3      FUNCTION TRUE(X,Y)
3      COMMON /CONCOM/ PI, FOURPI
3      DATA PI, FOURPI /3.1415926535898,12.566370614359/
3      PHI = 4.*((X-0.5)**2 + (Y-0.5)**2)
3      T1 = 5.4 - COS(FOURPI*X)
3      T2 = SIN(PI*X)
3      T3 = Y**2 - Y
3      T4 = 5.4 - COS(FOURPI*Y)
3      T5 = 1./(1.+PHI**4) - 0.5
3      TRUE = -0.31 * T1 * T2 * T3 * T4 * T5
3      RETURN
3      END
3      FUNCTION F(X,Y)
3      COMMON /CONCOM/ PI, FOURPI
3      CFPX = COS(FOURPI*X)
3      T1   = 5.4 - CFPX
3      T1X  = FOURPI*SIN(FOURPI*X)
3      T1XX = FOURPI**2*CFPX
3      T2   = SIN(PI*X)
3      T2X  = PI*COS(PI*X)
3      T2XX = -PI**2*T2
3      T3   = Y**2 - Y
3      T3Y  = 2.*Y - 1.
3      T3YY = 2.
3      CFPY = COS(FOURPI*Y)
3      T4 = 5.4 - CFPY
3      T4Y  = FOURPI*SIN(FOURPI*Y)
3      T4YY = FOURPI**2*CFPY
3      PHI  = 4.*((X-0.5)**2 + (Y-0.5)**2)
3      PHI2 = PHI**2
3      PHI3 = PHI2*PHI
3      PHI4 = PHI3*PHI
3      PHIX = 8.*(X-0.5)
3      PHIXX= 8.
3      PHIY = 8.*(Y-0.5)
3      PHIYY= 8.
3      TMP  = 1./(1.+PHI4)
3      TMP2 = TMP**2
3      TMP3 = TMP2*TMP
3      T5   = TMP - 0.5
3      T5X  = -4.*PHI3*PHIX*TMP2
3      T5XX = 32.*(PHI3*PHIX)**2*TMP3 - 12.*PHI2*PHIX**2*TMP2
3     $       - 4.*PHI3*PHIXX*TMP2
3      T5Y  = -4.*PHI3*PHIY*TMP2
3      T5YY = 32.*(PHI3*PHIY)**2*TMP3 - 12.*PHI2*PHIY**2*TMP2
3     $       - 4.*PHI3*PHIYY*TMP2
3      U    = T1 * T2 * T3 * T4 * T5
3      UXX  = T3 * T4 * (   T1XX*T2*T5 +
3     $                   2.*T1X*T2X*T5 +
3     $                   2.*T1X*T2*T5X +
3     $                      T1*T2XX*T5 +
3     $                   2.*T1*T2X*T5X +
3     $                      T1*T2*T5XX)
3      UYY  = T1 * T2 * (   T3YY*T4*T5 +
3     $                   2.*T3Y*T4Y*T5 +
3     $                   2.*T3Y*T4*T5Y +
3     $                      T3*T4YY*T5 +
3     $                   2.*T3*T4Y*T5Y +
3     $                      T3*T4*T5YY)
3      F    = -0.31 * ( UXX + UYY - COEFU(X,Y)*U )
3      RETURN
3      END
3      FUNCTION COEFU(X,Y)
3      COMMON /CONCOM/ PI, FOURPI
3      COEFU = 100. + COS(2.*PI*X) + SIN(3.*PI*Y)
3      RETURN
3      END
```

```
'EOR
'EOF
**************
* PROBLEM   7 *
**************
```

```
'EOR
*
*         002.10    000.00    000.00    050.10
*         2020021002002
1         TWO DIMENSIONS $ CONSTANT COEFFICIENTS $ POISSON
1         UXX$ + UYY$ = 1.
2         DIRICHLET $ HOMOGENEOUS
2         X=0. , U=0.
2         X=1. , U=0.
2         Y=0. , U=0.
2         Y=1. , U=0.
3      FUNCTION TRUE(X,Y)
3      DIMENSION  XB(4), YB(4), AB(4), C(11)
3      DATA N/16/, NZB/4/, NA/2/,
3     $      XB(1),YB(1), XB(2),YB(2), XB(3),YB(3), XB(4),YB(4)
3     $      /  0.,   0.,    1.,    0.,    1.,    1.,    0.,   1./,
3     $      AB / -2.356, -0.785,  0.785,  2.356/
3      DATA C
3     $      / .1469342607553E+00, .2000000125656E+01, .1000000062926E+01,
3     $       -.2833663320768E-01,-.9430879389879E-03, .4338951975566E-05,
3     $        .2394115480351E-05, .3183099062144E+00,-.3183099062144E+00,
3     $        .3183099062144E+00,-.3183099062144E+00/
3      DATA  PI/3.14159265358979/, TWOPI/6.28318530717959/
3      OABS(X,Y) = SQRT(X*X + Y*Y)
3      RCST = X - 0.5
3      RSNT = Y - 0.5
3      R = OABS(RCST, RSNT)
3      SUM = R*R/4.
3      L = 1
3      SUM = SUM + C(L)
3      RKCSKT = 1
3      RKSNKT = 0
3      DO 1 K=1,N
3         TEMP   = RCST*RKCSKT - RSNT*RKSNKT
3         RKSNKT = RSNT*RKCSKT + RCST*RKSNKT
3         RKCSKT = TEMP
3         IF ((K.GT.2) .AND. (MOD(K,4).NE.0))  GO TO 1
3         L = L+1
3         SUM = SUM + C(L)*RKCSKT
3    1 CONTINUE
3      DO 2 I=1,NZB
3         ZR = X - XB(I)
3         ZI = Y - YB(I)
3         WR = OABS(ZR, ZI)
3         IF (WR .NE. 0.)  WR = ALOG(WR)
3         WI = OARG(ZR, ZI)
3         IF (WI .GT. AB(I))  WI = WI - TWOPI
3         TR = ZR*WR - ZI*WI
3         TI = ZR*WI + ZI*WR
3         L = L+1
3         SUM = SUM + C(L)*(ZR*TI + ZI*TR)
3    2 CONTINUE
3      TRUE = SUM
3      RETURN
3      END
3      REAL FUNCTION  OARG(X, Y)
3      OARG = 0
3      IF ((X.NE.0.) .OR. (Y.NE.0.))  OARG = ATAN2(Y,X)
3      RETURN
3      END
-------------------------------------------------------------------------------
'EOR
'EOF
***************
* PROBLEM   8 *
***************
'EOR
*PARAMETER SET   1(A=0.1)
*         000.32    070.30    000.00    050.40
EXPAND 8/0.1/
'EOR
*PARAMETER SET   2(A=0.15)
*         000.33    080.40    000.00    060.50
EXPAND 8/0.15/
'EOR
*PARAMETER SET   3(A=0.35)
```

```
*          000.38    030.40    000.00    060.50
EXPAND 8/0.35/
'EOR
*PARAMETER SET   4(A=0.45)
*          000.42    080.40    000.00    070.60
EXPAND 8/0.45/
-----------------------------------------------------------------------
'EOR
'EOF
**********
* PROBLEM   9 *
**********
'EOR
*PARAMETER SET   1(A=10.0)
*          002.18    040.10    000.00    006.60
EXPAND 9/10./
'EOR
*PARAMETER SET   2(A=20.0)
*          002.26    040.45    000.00    006.65
EXPAND 9/20./
'EOR
*PARAMETER SET   3(A=50.0)
*          002.27    040.45    000.00    006.70
EXPAND 9/50./
'EOR
*PARAMETER SET   4(A=100.0)
*          002.23    040.45    000.00    006.80
EXPAND 9/100./
-----------------------------------------------------------------------
'EOR
'EOF
***************
* PROBLEM  10 *
***************
'EOR
*PARAMETER SET   1(A=10.0, B=0.5)
*          000.04    005.10    000.00    005.05
EXPAND 10/10.,.5/
'EOR
*PARAMETER SET   2(A=50.0, B=0.5)
*          000.16    025.40    000.00    008.25
EXPAND 10/50.,.5/
'EOR
*PARAMETER SET   3(A=100.0, B=0.5)
*          000.23    040.60    000.00    010.30
EXPAND 10/100.,.5/
'EOR
*PARAMETER SET   4(A=500.0, B=0.5)
*          000.32    065.70    000.00    020.35
EXPAND 10/500.,.5/
'EOR
*PARAMETER SET   5(A=1000.0, B=0.5)
*          000.38    080.75    000.00    035.40
EXPAND 10/1000.,.5/
'EOR
*PARAMETER SET   6(A=10.0, B=0.117)
*          000.04    005.10    000.00    005.05
EXPAND 10/10.,.117/
'EOR
*PARAMETER SET   7(A=50.0, B=0.117)
*          000.16    025.40    000.00    008.25
EXPAND 10/50.,.117/
'EOR
*PARAMETER SET   8(A=100.0, B=0.117)
*          000.23    040.60    000.00    010.30
EXPAND 10/100.,.117/
'EOR
*PARAMETER SET   9(A=500.0, B=0.117)
*          000.32    065.70    000.00    020.35
EXPAND 10/500.,.117/
'EOR
*PARAMETER SET  10(A=1000.0, B=0.117)
*          000.38    080.75    000.00    035.40
EXPAND 10/1000.,.117/
-----------------------------------------------------------------------
'EOR
```

```
'EOF
**************
* PROBLEM  11 *
**************
'EOR
*PARAMETER SET   1(A=PI)
*          000.10    006.25    000.00    006.25
EXPAND 11/PI/
'EOR
*PARAMETER SET   2(A=2*PI)
*          000.14    006.35    000.00    006.35
EXPAND 11/2.*PI/
'EOR
*PARAMETER SET   3(A=3*PI)
*          000.15    006.40    000.00    006.40
EXPAND 11/3.*PI/
'EOR
*PARAMETER SET   4(A=5*PI)
*          000.22    006.60    000.00    006.60
EXPAND 11/5.*PI/
'EOR
*PARAMETER SET   5(A=10*PI)
*          000.27    006.75    000.00    006.75
EXPAND 11/10.*PI/
-------------------------------------------------------------------------------
'EOR
'EOF
**************
* PROBLEM  12 *
**************
'EOR
*PARAMETER SET   1(A=PI, B=PI)
*          000.05    006.10    000.00    006.10
EXPAND 12/3.14159265358979,3.14159265358979/
'EOR
*PARAMETER SET   2(A=PI, B=10.0)
*          000.12    006.30    000.00    006.30
EXPAND 12/3.14159265358979,10./
'EOR
*PARAMETER SET   3(A=10.0, B=PI)
*          000.12    006.30    000.00    006.30
EXPAND 12/10.,3.14159265358979/
'EOR
*PARAMETER SET   4(A=20.0, B=PI)
*          000.22    006.60    000.00    006.60
EXPAND 12/20.,3.14159265358979/
'EOR
*PARAMETER SET   5(A=10.0, B=10.0)
*          000.12    006.30    000.00    006.30
EXPAND 12/10.,10./
'EOR
*PARAMETER SET   6(A=10.0, B=20.0)
*          000.22    006.60    000.00    006.60
EXPAND 12/10.,20./
-------------------------------------------------------------------------------
'EOR
'EOF
**************
* PROBLEM  13 *
**************
'EOR
*          000.48    090.90    000.00    080.25
*          20000020020
1          TWO DIMENSIONS $ SELF-ADJOINT
1          COEF1(X,Y)UXX$ + UYY$ = F(X,Y)
2          DIRICHLET
2          X=0. , U=TRUE(X,Y)
2          X=1. , U=TRUE(X,Y)
2          Y=0. , U=TRUE(X,Y)
2          Y=1. , U=TRUE(X,Y)
3      FUNCTION COEF1(X,Y)
3      COEF1 = 2.
3      IF ( X.LT..4 ) COEF1 =1.
3      RETURN
3      END
```

```
3      FUNCTION F(X,Y)
3      FX1 = X + .3
3      FX2 = .7 + .5*(X-.4) + (X-.4)**2/(1+X*X)
3      DYYG = (Y*Y-G.*Y+7.)*EXP(-Y)
3      IF (FX1 .GT. FX2)  GO TO 1
3         F = DYYG*FX1
3         RETURN
3    1 DXXH = ((1.6*X+1.68)*(1+X*X)**2
3     $       -(.8*X*X+1.68*X-.8)*4.*X*(1.+X*X))
3     $       /(1.+X*X)**4
3      G = 1. + (Y-1.)**2*EXP(-Y)
3      F = COEF1(X,Y)*DXXH*G + FX2*DYYG
3      END
3      RETURN
3      END
3      FUNCTION TRUE(X,Y)
3      FX2 = .7 + .5*(X-.4) + (X-.4)**2/(1+X*X)
3      TRUE =AMIN1(X+.3,FX2)*(1.+(Y-1.)**2*EXP(-Y))
3      RETURN
3      END
3      FUNCTION CDXU(X,Y)
3      CDXU = 0.
3      RETURN
3      END
3      FUNCTION CDYU(X,Y)
3      CDYU = 0.
3      RETURN
3      END
```

```
'EOR
'EOF
***************
* PROBLEM  14 *
***************
'EOR
*PARAMETER SET   1(A=0.01)
*          000.28    045.05    060.05    045.05
EXPAND 14/0.01/
'EOR
*PARAMETER SET   2(A=0.1)
*          000.34    060.05    070.05    060.05
EXPAND 14/0.1/
'EOR
*PARAMETER SET   3(A=1.0)
*          000.39    065.10    075.10    065.10
EXPAND 14/1.0/
```

```
'EOR
'EOF
***************
* PROBLEM  15 *
***************
'EOR
*PARAMETER SET   1(A=0.2, B=1.5, C=0.1)
*          000.28    055.00    000.00    070.00
EXPAND 15/.2,1.5,0.1/
'EOR
*PARAMETER SET   2(A=1.0, B=2.5, C=0.1)
*          000.17    050.00    000.00    050.00
EXPAND 15/1.,2.5,0.1/
'EOR
*PARAMETER SET   3(A=0.2, B=1.5, C=0.04)
*          000.27    090.00    000.00    070.00
EXPAND 15/.2,1.5,0.04/
'EOR
*PARAMETER SET   4(A=0.2, B=2.5, C=0.04)
*          000.15    040.00    000.00    050.00
EXPAND 15/.2,2.5,0.04/
```

```
'EOR
'EOF
***************
* PROBLEM  16 *
***************
'EOR
*PARAMETER SET   1(B=1.)
```

```
*          007.10     010.03     000.00     015.30
EXPAND 16/1,1./
'EOR
*PARAMETER SET   2(B=10.)
*          007.08     010.03     000.00     010.15
EXPAND 16/2,10./
-------------------------------------------------------------------------
'EOR
'EOF
***************
* PROBLEM  17 *
***************
'EOR
*PARAMETER SET   1(A=1.0, B=2.0)
*          000.08     002.20     000.00     010.15
EXPAND 17/1.,2./
'EOR
*PARAMETER SET   2(A=5.0, B=3.0)
*          000.20     010.50     000.00     020.40
EXPAND 17/5.,3./
'EOR
*PARAMETER SET   3(A=8.0, B=5.0)
*          000.45     040.80     000.00     080.70
EXPAND 17/8.,5./
-------------------------------------------------------------------------
'EOR
'EOF
***************
* PROBLEM  18 *
***************
'EOR
*PARAMETER SET   1(A=1.0, B=2.0)
*          000.07     010.10     000.00     010.10
EXPAND 18/1.,2./
'EOR
*PARAMETER SET   2(A=5.0, B=3.0)
*          000.11     010.20     000.00     020.15
EXPAND 18/5.,3./
'EOR
*PARAMETER SET   3(A=8.0, B=5.0)
*          000.32     010.70     000.00     070.40
EXPAND 18/8.,5./
-------------------------------------------------------------------------
'EOR
'EOF
***************
* PROBLEM  19 *
***************
'EOR
*PARAMETER SET   1(A=0.15)
*          008.15     070.10     000.00     006.05
EXPAND 19/0.15/
'EOR
*PARAMETER SET   2(A=0.25)
*          008.17     030.10     000.00     006.05
EXPAND 19/.25/
-------------------------------------------------------------------------
'EOR
'EOF
***************
* PROBLEM  20 *
***************
'EOR
*PARAMETER SET   1(A=0.0)
*          007.23     040.60     000.00     010.30
EXPAND 20/0./
'EOR
*PARAMETER SET   2(A=10.)
*          007.23     040.60     000.00     010.30
EXPAND 20/10./
-------------------------------------------------------------------------
'EOR
'EOF
***************
* PROBLEM  21 *
***************
```

```
.OR
*         003.03    010.20    000.00    006.10
*         2000000032000
1         TWO DIMENSIONS
1         A(X,Y)UXX$ + B(X,Y)UXY$ + C(X,Y)UYY$ = F(X,Y)
          DIRICHLET
          X=0. , U=TRUE(X,Y)
          X=1. , U=TRUE(X,Y)
          Y=0. , U=TRUE(X,Y)
          Y=1. , U=TRUE(X,Y)
3       FUNCTION A(X,Y)
3       A = 1. + TRUEX(X,Y)**2
3       RETURN
3       END
3       FUNCTION B(X,Y)
3       B = -2.*TRUEX(X,Y)*TRUEY(X,Y)
3       RETURN
3       END
3       FUNCTION C(X,Y)
3       C = 1. + TRUEY(X,Y)**2
3       RETURN
3       END
3       FUNCTION TRUEX(X,Y)
3       TRUEX = EXP(X+Y)
3       RETURN
3       END
3       FUNCTION TRUEY(X,Y)
3       TRUEY = EXP(X+Y)
3       RETURN
3       END
3       FUNCTION F(X,Y)
3       TUXX = EXP(X+Y)
3       TUXY = TUXX
3       TUYY = TUXY
3       F = A(X,Y)*TUXX + B(X,Y)*TUXY + C(X,Y)*TUYY
3       RETURN
3       END
3       FUNCTION TRUE(X,Y)
3       TRUE = EXP(X+Y)
3       RETURN
3       END
```

```
'EOR
'EOF
**************
* PROBLEM  22 *
**************
'EOR
*         003.31    090.85    000.00    004.05
          2000200032000
          TWO DIMENSIONS
          U(X,Y)UXXS + U(X,Y)UYY$  + WX(X,Y)UX$ +
1.        WY(X,Y)UY$ = F(X,Y)
          DIRICHLET
          X=0. , U=TRUE(X,Y)
          X=1. , U=TRUE(X,Y)
          Y=0. , U=TRUE(X,Y)
          Y=1. , U=TRUE(X,Y)
3       FUNCTION U(X,Y)
3       COMMON /CONCOM/ C1,C2
3       DATA C1, C2/ 17.06, 3.62/
3       F1 = (X*X-1.)*(Y*Y-1.)
3       DXF1 = 2.*X*(Y*Y-1.)
3       DYF1 = (X*X-1.)*2.*Y
3       UX = C1*DXF1 + C2*DXF1*(X*X+Y*Y) + C2*F1*2.*X
3       UY = C1*DYF1 + C2*DYF1*(X*X+Y*Y) + C2*F1*2.*Y
3       A = SQRT(U*UX + U*UY)
3       U = 2000.
3       IF (A .GT. .0025) U = 10.4/A + 230.
3       RETURN
3       END
3       FUNCTION WX(X,Y)
3       COMMON /CONCOM/ C1,C2
3       F1 = (X*X-1.)*(Y*Y-1.)
```

```
3      DXF1 = 2.*X*(Y*Y-1.)
3      DYF1 = (X*X-1.)*2.*Y
3      UX = C1*DXF1 + C2*DXF1*(X*X+Y*Y) + C2*F1*2.*X
3      UY = C1*DYF1 + C2*DYF1*(X*X+Y*Y) + C2*F1*2.*Y
3      DXXF1 = 2.*(Y*Y-1.)
3      DYXF1 = 4.*X*Y
3      UXX = C1*DXXF1 + C2*DXXF1*(X*X+Y*Y) + C2*DXF1*2.*X +
3     $       C2*DXF1*2.*X + C2*F1*2.
3      UYX = C1*DYXF1 + C2*DYXF1*(X*X+Y*Y) + C2*DYF1*2.*X +
3     $       C2*DXF1*2.*Y
3      A = SQRT(UX*UX + UY*UY)
3      WX = 0.
3      IF (A .GT. .0025) WX = -19.4*(UX*UXX + UY*UYX)/A**3
3      RETURN
3      END
3      FUNCTION WY(X,Y)
3      WY = WX(Y,X)
3      RETURN
3      END
3      FUNCTION TRUE(X,Y)
3      COMMON /CONCOM/ C1,C2
3      F1 = (X*X-1.)*(Y*Y-1.)
3      TRUE = C1*F1 + C2*F1*(X*X+Y*Y)
3      RETURN
3      END
3      FUNCTION F(X,Y)
3      COMMON /CONCOM/ C1,C2
3      F1 = (X*X-1.)*(Y*Y-1.)
3      DXF1 = 2.*X*(Y*Y-1.)
3      DYF1 = (X*X-1.)*2.*Y
3      UX = C1*DXF1 + C2*DXF1*(X*X+Y*Y) + C2*F1*2.*X
3      UY = C1*DYF1 + C2*DYF1*(X*X+Y*Y) + C2*F1*2.*Y
3      DXXF1 = 2.*(Y*Y-1.)
3      DYYF1 = (X*X-1.)*2.
3      UXX = C1*DXXF1 + C2*DXXF1*(X*X+Y*Y) + C2*DXF1*2.*X +
3     $       C2*DXF1*2.*X + C2*F1*2.
3      UYY = C1*DYYF1 + C2*DYYF1*(X*X+Y*Y) + C2*DYF1*2.*Y +
3     $       C2*DYF1*2.*Y + C2*F1*2.
3      F = W(X,Y)*(UXX+UYY) + WX(X,Y)*UX + WY(X,Y)*UY
3      RETURN
3      END
-------------------------------------------------------------------------------
'EOR
'EOF
**************
* PROBLEM  23 *
**************
'EOR
*PARAMETER SET   1(A=387.75, B=50.0, C=1, D=0.10)
*          009.47    060.70    020.00    070.60
EXPAND 23/387.75,50.,1,0.10/
'EOR
*PARAMETER SET   2(A=554.5, B=0.554, C=1, D=0.10)
*          009.50    070.80    020.00    070.60
EXPAND 23/554.5,.544,1,0.10/
'EOR
*PARAMETER SET   3(A=387.75, B=50.0, C=2, D=0.15)
*          009.52    080.80    020.00    070.60
EXPAND 23/387.75,50.,2,0.15/
'EOR
*PARAMETER SET   4(A=554.5, B=0.554, C=2, D=0.15)
*          009.52    080.80    020.00    070.60
EXPAND 23/554.5,.544,2,0.15/
'EOR
*PARAMETER SET   5(A=387.75, B=50.0, C=3, D=0.20)
*          009.53    085.80    020.00    070.60
EXPAND 23/387.75,50.,3,0.20/
'EOR
*PARAMETER SET   6(A=554.5, B=0.554, C=3, D=0.20)
*          009.53    085.85    020.00    070.60
EXPAND 23/554.5,.544,3,0.20/
-------------------------------------------------------------------------------
'EOR
'EOF
**************
* PROBLEM  24 *
```

```
****************
'EOR
*PARAMETER SET   1(A=0.25, B=100., C=-0.10)
*          007.13    015.10    005.00    015.30
EXPAND 24/0.25,100.,-0.10,1/
'EOR
*PARAMETER SET   2(A=0.25, B=1000., C=-0.10)
*          007.09    015.10    005.00    010.15
EXPAND 24/0.25,1000.,-0.10,2/
'EOR
*PARAMETER SET   3(A=0.50, B=1., C=-0.01)
*          007.06    015.10    005.00    005.00
EXPAND 24/0.50,1.,-0.01,3/
'EOR
*PARAMETER SET   4(A=0.50, B=10., C=-0.10)
*          007.07    015.10    005.00    010.00
EXPAND 24/0.50,10.,-0.10,4/
'EOR
*PARAMETER SET   5(A=1.00, B=1., C=-0.10)
*          007.05    015.10    005.00    000.00
EXPAND 24/1.00,1.,-0.10,5/
'EOR
*PARAMETER SET   6(A=1.00, B=10., C=-0.10)
*          007.07    015.10    005.00    010.00
EXPAND 24/1.00,10.,-0.10,6/
'EOR
*PARAMETER SET   7(A=1.00, B=100., C=-1.00)
*          007.14    015.10    005.00    015.37
EXPAND 24/1.00,100.,-1.00,7/
'EOR
*PARAMETER SET   8(A=1.00, B=1000., C=-1.00)
*          007.10    015.10    005.00    010.20
EXPAND 24/1.00,1000.,-1.00,8/
-------------------------------------------------------------------------------
'EOR
'EOF
***************
* PROBLEM  25 *
***************
'EOR
*PARAMETER SET   1(A=1.5)
*          000.19    065.40    000.00    006.05
EXPAND 25/1.5/
'EOR
*PARAMETER SET   2(A=2.5)
*          000.14    055.20    000.00    006.05
EXPAND 25/2.5/
'EOR
*PARAMETER SET   3(A=3.5)
*          000.12    045.15    000.00    006.05
EXPAND 25/3.5/
'EOR
*PARAMETER SET   4(A=4.5)
*          000.11    035.20    000.00    006.05
EXPAND 25/4.5/
-------------------------------------------------------------------------------
'EOR
'EOF
***************
* PROBLEM  26 *
***************
'EOR
*PARAMETER SET   1(A=1)
*          007.03    010.00    000.00    005.02
EXPAND 26/1.,1/
'EOR
*PARAMETER SET   2(A=5)
*          007.04    010.00    000.00    010.02
EXPAND 26/5.,2/
'EOR
*PARAMETER SET   3(A=10)
*          008.04    010.00    000.00    013.02
EXPAND 26/10.,3/
-------------------------------------------------------------------------------
'EOR
'EOF
```

```
**************
* PROBLEM  27 *
**************
'EOR
*
*        007.13    015.05    000.00    020.40
*        20002000002002
1        TWO DIMENSIONS
1        UXX$ + (1.[illegible]**2)UYY$ + (2./X)UX$ + E(X,Y)UY$ = -100.
2        DIRICHLET $ HOMOGENEOUS
2        X=.1 , U=0.
2        X=1. , U=0.
2        Y=.1 , U=0.
2        Y=1. , U=0.
3      FUNCTION TRUE(X,Y)
3      REAL DERVSL(6), GRID(20), TABLE(20,20),
3     $     T1B1(100), T1B2(100), T1B3(100), T1B4(100)
3      EQUIVALENCE (TABLE(1, 1) , T1B1(1)),
3     $            (TABLE(1, 6) , T1B2(1)),
3     $            (TABLE(1,11) , T1B3(1)),
3     $            (TABLE(1,16) , T1B4(1))
3      DATA NGRID, NGRID/20, 20/
3      DATA  GRID/0.1000000, 0.1473684, 0.1947368, 0.2421053,
3     $0.2894737, 0.3368421, 0.3842105, 0.4315789, 0.4789474,
3     $0.5263158, 0.5736842, 0.6210526, 0.6684211, 0.7157895,
3     $0.7631579, 0.8105263, 0.8578948, 0.9052632, 0.9526316,
3     $1.0000000/
3C
3C     APPROXIMATE SOLUTION OF PROBLEM USING
3C     5-POINT STAR (20 X 20 GRID)
3C
3      DATA T1B1/  .000000,  .000000,  .000000,  .000000,  .000000,
3     $  .000000,  .000000,  .000000,  .000000,  .000000,  .000000,
3     $  .000000,  .000000,  .000000,  .000000,  .000000,  .000000,
3     $  .000000,  .000000,  .000000,  .000000,  .881855, 1.596811,
3     $ 2.331137, 3.089375, 3.848034, 4.576355, 5.244113, 5.821652,
3     $ 6.280833, 6.595470, 6.741719, 6.692443, 6.447540, 5.974205,
3     $ 5.267140, 4.318752, 3.124975, 1.633172,  .000000,  .000000,
3     $  .212529,  .334810,  .561946,  .745076,  .928383, 1.104687,
3     $ 1.266551, 1.407139, 1.519365, 1.593898, 1.634250, 1.625968,
3     $ 1.567710, 1.455309, 1.287426, 1.060924,  .774514,  .427498,
3     $  .000000,  .000000,  .552663, 1.090754, 1.461024, 1.936419,
3     $ 2.411748, 2.863264, 3.286824, 3.648225, 3.936538, 4.133688,
3     $ 4.225089, 4.197475, 4.039408, 3.741501, 3.295544, 2.695630,
3     $ 1.948547, 1.045257,  .000000,  .000000,  .473224,  .859904,
3     $ 1.251265, 1.658857, 2.066712, 2.458312, 2.819739, 3.130717,
3     $ 3.379439, 3.550301, 3.631853, 3.611042, 3.473392, 3.225649,
3     $ 2.846377, 2.336002, 1.691793,  .912354,  .000000/
3C
3      DATA T1B2/  .000000,  .464137,  .840562, 1.227614, 1.627875,
3     $ 2.020554, 2.414265, 2.768364, 3.076216, 3.322010, 3.492081,
3     $ 3.573500, 3.555061, 3.428469, 3.179470, 2.807439, 2.305741,
3     $ 1.671219,  .903587,  .000000,  .000000,  .455331,  .825554,
3     $ 1.205033, 1.590304, 1.[illegible], 2.374329, 2.724141, 3.026027,
3     $ 3.272186, 3.4[illegible], 3.524[illegible], 3.50[illegible], 3.334063, 3.142234,
3     $ 2.777809, 2.[illegible], 1.659372,  .875336,  .000000,  .000000,
3     $  .445506,  .809807, 1.178974, 1.594531, 1.951395, 2.324591,
3     $ 2.668757, 2.930350, 3.219426, 3.378529, 3.434340, 3.452336,
3     $ 3.[illegible]33506, 3.039227, 2.742003, 2.2[illegible]30, 1.633713,  .806756,
3     $  .000000,  .000000,  .433193,  .712752, 1.144207, 1.519047,
3     $ 1.836254, 2.[illegible]0543, 2.597361, 2.[illegible]076, 3.130585, 3.290491,
3     $ 3.335145, 3.373307, 3.297262, 3.042015, 2.685453, 2.221455,
3     $ 1.615767,  .875512,  .000000,  .000000,  .415416,  .752404,
3     $ 1.100502, 1.432205, 1.[illegible], 2.170285, 2.506541, 2.704171,
3     $ 3.[illegible], 3.[illegible], 3.[illegible], 3.2[illegible]077, 3.13[illegible]342, 2.987696,
3     $ 2.634321, 2.176[illegible],  1.533775,  .861003,  .000000/
3C
3      DATA T1B3/  .000000,  .334736,  .714031, 1.049437, 1.391534,
3     $ 1.[illegible], 2.[illegible], 2.[illegible]379, 2.671725, 2.900431, 3.066651,
3     $ 3.[illegible], 3.[illegible]7, 3.071040, 2.[illegible], 2.5[illegible]43, 2.110085,
3     $ 1.[illegible],  .[illegible]112,  .000000,  .000000,  .[illegible]313,  .060877,
3     $  .[illegible], 1.[illegible], 1.[illegible]778, 1.[illegible]333, 2.[illegible]181, 2.521753,
3     $ 2.7[illegible], 2.[illegible], 2.[illegible]306, 3.[illegible]733, 2.[illegible]584, 2.751741,
3     $ 2.[illegible]077, 2.[illegible], 1.[illegible]35,  .317794,  .000000,  .000000,
3     $  .[illegible]371,  .[illegible]13,  .[illegible]313, 1.204495, 1.509717, 1.8[illegible]544,
3     $ 2.[illegible], 2.[illegible]1033, 2.[illegible]314, 2.710515, 2.[illegible]033, 2.82[illegible]784,
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3     $ 2.762054, 2.600729, 2.332121, 1.948103, 1.432518,  .786696,
3     $  .000000,  .000000,  .308205,  .554849,  .813884, 1.086018,
3     $ 1.363342, 1.636051, 1.896833, 2.126706, 2.324089, 2.475758,
3     $ 2.571278, 2.600023, 2.551104, 2.413333, 2.175292, 1.825479,
3     $ 1.352757,  .747003,  .000000,  .000000,  .287185,  .483919,
3     $  .710355,  .949965, 1.124603, 1.236371, 1.286473, 1.276015,
3     $ 2.056626, 2.197396, 2.230763, 2.226271, 2.293903, 2.182323,
3     $ 1.979744, 1.673420, 1.246394,  .696174,  .000000/
3C
3      DATA T1B4/  .000000,  .223254,  .404271,  .594571,  .795868,
3     $ 1.002731, 1.208281, 1.405230, 1.586414, 1.744185, 1.870977,
3     $ 1.958768, 1.993052, 1.982549, 1.893309, 1.736364, 1.481378,
3     $ 1.116459,  .630463,  .000000,  .000000,  .174435,  .315761,
3     $  .465007,  .623554,  .787267,  .950892, 1.103899, 1.255644,
3     $ 1.385363, 1.492081, 1.569477, 1.610602, 1.607997, 1.552498,
3     $ 1.433466, 1.237622,  .948177,  .544009,  .000000,  .000000,
3     $  .120825,  .218604,  .322383,  .433139,  .548090,  .663693,
3     $  .776212,  .881823,  .976602, 1.056454, 1.116897, 1.153396,
3     $ 1.160107, 1.130482, 1.058126,  .925841,  .723818,  .426737,
3     $  .000000,  .000000,  .062593,  .113172,  .167151,  .225042,
3     $  .285452,  .346593,  .408606,  .463546,  .515437,  .560198,
3     $  .595592,  .619121,  .627831,  .618299,  .585595,  .523407,
3     $  .420924,  .253428,  .000000,  .000000,  .000000,  .000000,
3     $  .000000,  .000000,  .000000,  .000000,  .000000,  .000000,
3     $  .000000,  .000000,  .000000,  .000000,  .000000,  .000000,
3     $  .000000,  .000000,  .000000,  .000000,  .000000/
3C
3C     INTERPOLATE NUMERICAL SOLUTION BY QUADRATICS
3C
3      CALL QUADRD(X,Y,TABLE,GRID,GRID,NGRID,NGRID,NGRDD,NGRDD,DERVSL)
3C
3      TRUE = DERVSL(6)
3C
3      RETURN
3      END
3      FUNCTION E(X,Y)
3      E = 1./(TAN(Y)**3*X**2)
3      RETURN
3      END
-------------------------------------------------------------------------------
'EOR
'EOF
***************
* PROBLEM  28 *
***************
'EOR
*PARAMETER SET   1(A=1.)
*          008.03    000.00    005.00    007.03
EXPAND 28/1.,1/
'EOR
*PARAMETER SET   2(A=10.)
*          008.05    000.00    005.00    010.15
EXPAND 28/10.,2/
'EOR
*PARAMETER SET   3(A=100.)
*          008.06    000.00    005.00    010.22
EXPAND 28/100.,3/
-------------------------------------------------------------------------------
'EOR
'EOF
***************
* PROBLEM  29 *
***************
'EOR
*PARAMETER SET   1(A=-3.)
*          008.18    090.05    000.02    010.02
EXPAND 29/-3.,1/
'EOR
*PARAMETER SET   2(A=-1.)
*          008.18    090.05    000.00    010.00
EXPAND 29/-1.,2/
'EOR
*PARAMETER SET   3(A=1.)
*          008.19    090.05    000.00    010.10
EXPAND 29/1.,3/
'EOR
```

```
*PARAMETER SET   4(A=3.)
*          008.21    090.05    000.00    010.20
EXPAND 29/3.,4/
'EOR
*PARAMETER SET   5(A=5.)
*          008.20    090.05    000.00    010.15
EXPAND 29/5.,5/
-------------------------------------------------------------------------
'EOR
'EOF
****************
* PROBLEM  30 *
****************
'EOR
*PARAMETER SET   1(A=1.0, B=8.0, C=-1.0)
*          000.16    010.40    000.00    010.35
EXPAND 30/1.,8.,-1./
'EOR
*PARAMETER SET   2(A=1.0, B=2.0, C=0.5)
*          000.06    006.10    000.00    006.15
EXPAND 30/1.,2.,5./
'EOR
*PARAMETER SET   3(A=23.0, B=2.0, C=1.0)
*          000.19    030.30    000.00    030.25
EXPAND 30/23.,2.,1./
'EOR
*PARAMETER SET   4(A=10.0, B=11.0, C=0.0)
*          000.13    010.30    000.00    015.25
EXPAND 30/10.,11.,0./
'EOR
*PARAMETER SET   5(A=100.0, B=2.0, C=2.0)
*          000.19    030.30    000.00    030.25
EXPAND 30/100.,2.,2./
'EOR
*PARAMETER SET   6(A=10.0, B=4.0, C=1.0)
*          000.13    010.30    000.00    015.25
EXPAND 30/10.,4.,1./
'EOR
*PARAMETER SET   7(A=4.0, B=5.0, C=-0.5)
*          000.10    006.25    000.00    010.20
EXPAND 30/4.,5.,-0.5/
'EOR
*PARAMETER SET   8(A=3.0, B=6.0, C=2.0)
*          000.10    006.25    000.00    006.25
EXPAND 30/3.,6.,2./
'EOR
*PARAMETER SET   9(A=0.5, B=3.0, C=10.0)
*          000.09    006.20    000.00    006.20
EXPAND 30/.5,3.,10./
-------------------------------------------------------------------------
'EOR
'EOF
****************
* PROBLEM  31 *
****************
'EOR
*
*          009.04    002.00    004.08    006.05
*          2020021000020
1          TWO DIMENSIONS $ CONSTANT COEFFICIENTS $ POISSON
1          UXX$ + UYY$ = -1.
2          MIXED
2          X=-1. , MIXED = (1.)U + (-1.)UX = TRUE(X,Y) - DUX(X,Y)
2          X= 1. , MIXED = (1.)U + ( 1.)UX = TRUE(X,Y) + DUX(X,Y)
2          Y=-1. , MIXED = (1.)U + (-1.)UY = TRUE(X,Y) - DUY(X,Y)
2          Y= 1. , MIXED = (1.)U + ( 1.)UY = TRUE(X,Y) + DUY(X,Y)
3      FUNCTION TRUE(X,Y)
3      COMMON /CONCOM/ A0,A2,A4,A6
3      DATA A0,A2,A4,A6 /.821564,-.0144,.0000493,-.00000064/
3      X2 = X*X
3      X4 = X2*X2
3      X6 = X4*X2
3      X8 = X6*X2
3      X10= X8*X2
3      X12= X10*X2
3      Y2 = Y*Y
```

```
3      Y4 = Y2*Y2
3      Y6 = Y4*Y2
3      Y8 = Y6*Y2
3      Y10= Y8*Y2
3      Y12= Y10*Y2
3      TRUE = -.25*(X2+Y2) + A0 + A2*(X4-6.*X2*Y2+Y4)
3     $        + A4*(X8-28.*X6*Y2+70.*X4*Y4-28.*X2*Y6+Y8)
3     $        + A6*(X12-66.*X10*Y2+495.*X8*Y4-924.*X6*Y6+
3     $              495.*X4*Y8-66.*X2*Y10+Y12)
3      RETURN
3      END
3      FUNCTION DUX(X,Y)
3      COMMON /CONCOM/ A0,A2,A4,A6
3      X2 = X*X
3      X3 = X*X2
3      X5 = X3*X2
3      X7 = X5*X2
3      X9 = X7*X2
3      X11= X9*X2
3      Y2 = Y*Y
3      Y4 = Y2*Y2
3      Y6 = Y4*Y2
3      Y8 = Y6*Y2
3      Y10= Y8*Y2
3      DUX = -.5*X + A2*(4.*X3-12.*X*Y2) +
3     $       A4*(8.*X7-168.*X5*Y2+280.*X3*Y4-56.*X*Y6) +
3     $       A6*(12.*X11-660.*X9*Y2+3960.*X7*Y4-5544.*X5*Y6+
3     $           1980.*X3*Y8-132.*X*Y10)
3      RETURN
3      END
3      FUNCTION DUY(X,Y)
3      DUY = DUX(Y,X)
3      RETURN
3      END
-------------------------------------------------------------------------
'EOR
'EOF
****************
* PROBLEM  32 *
****************
'EOR
*
*          009.07    010.05    000.00    010.15
*          2000200002002
1          TWO DIMENSIONS
1          UXX$ + UYY$ + 3./(5.-Y)UY$ = F(X,Y)
2          DIRICHLET $ HOMOGENEOUS
2          X=-.5 , U=0.
2          X= .5 , U=0.
2          Y=-1. , U=0.
2          Y= 1. , U=0.
3      FUNCTION TRUE(X,Y)
3      DATA A,B /.0010185,.0004838/
3      TRUE = (1.-Y*Y)*(1.-4.*X*X)*(5.-Y)**3*(A+B*Y)
3      RETURN
3      END
3      FUNCTION F(X,Y)
3      DATA A,B /.0010185,.0004838/
3      Z = A-A*Y**2+B*Y-B*Y**3
3      Q = 1.-4.*X**2
3      T = 5.-Y
3      T2 = T*T
3      T3 = T2*T
3      UXX = -8.*Z*T3
3      UY  = Q*((B-2.*A*Y-3.*B*Y**2)*T3 -3.*Z*T2)
3      UYY = Q*((-2.*A-6.*B*Y)*T3 - 6.*(B-2.*A*Y-3.*B*Y**2)*T2
3     $        + 6.*Z*T)
3      F   = UXX + UYY + 3./(5.-Y)*UY
3      RETURN
3      END
-------------------------------------------------------------------------
'EOR
'EOF
****************
* PROBLEM  33 *
****************
```

```
'EOR
*
*         008.11    006.20    000.10    006.25
*         20200?1002000
1         TWO DIMENSIONS $ CONSTANT COEFFICIENTS $ POISSON
1         UXX$ + UYY$ = F(X,Y)
2         DIRICHLET
2         X= 0. , U=TRUE(X,Y)
2         X= 1. , U=TRUE(X,Y)
2         Y=-1. , U=TRUE(X,Y)
2         Y= 1. , U=TRUE(X,Y)
3     FUNCTION TRUE(X,Y)
3     S133 = SQRT(133.)
3     K1 = SQRT(14.+S133)
3     K2 = SQRT(14.-S133)
3     A = (-7.+S133)/(2.*S133)
3     B = (-7.-S133)*A/16.
3     EK1X = EXP(K1*X)
3     EK2X = EXP(K2*X)
3     EDIFF = EK1X - EK2X
3     F1 = A*EDIFF + EK2X
3     F2 = B*EDIFF
3     Y21 = 1.-Y*Y
3     TRUE = Y21*(F1 + Y21*F2)
3     RETURN
3     END
3     FUNCTION F(X,Y)
3     S133 = SQRT(133.)
3     K1 = SQRT(14.+S133)
3     K2 = SQRT(14.-S133)
3     A = (-7.+S133)/(2.*S133)
3     B = (-7.-S133)*A/16.
3     EK1X = EXP(K1*X)
3     EK2X = EXP(K2*X)
3     EDIFF = EK1X-EK2X
3     F1 = A*EDIFF + EK2X
3     F2 = B*EDIFF
3     Y21 = 1.-Y*Y
3     DEK1X = K1*K1*EK1X
3     DEK2X = K2*K2*EK2X
3     DEDIFF = DEK1X - DEK2X
3     DDF1 = A*DEDIFF + DEK2X
3     DDF2 = B*DEDIFF
3     UXX = Y21*(DDF1 + Y21*DDF2)
3     UYY = -2.*(F1 + 2.*(1.-3.*Y*Y)*F2)
3     F = UXX + UYY
3     RETURN
3     END
-------------------------------------------------------------------------------
'EOR
'EOF
***************
* PPOBLEM  34 *
***************
'EOP
*
*         008.03    002.01    000.01    006.05
*         20200?1002000
1         TWO DIMENSIONS $ CONSTANT COEFFICIENTS $ POISSON
1          UXX$ + UYY$ = -1.
2         DIRICHLET
2         X=-1. , U=TRUE(X,Y)
2         X= 1. , U=TRUE(X,Y)
2         Y=-1. , U=TRUE(X,Y)
2         Y= 1. , U=TRUE(X,Y)
3     FUNCTION TRUE(X,Y)
3     X2 = X*X
3     X4 = X2*X2
3     X6 = X4*X2
3     X8 = X6*X2
3     Y2 = Y*Y
3     Y4 = Y2*Y2
3     Y6 = Y4*Y2
3     Y8 = Y6*Y2
3     TRUE = 0.235776 - .25*(X2+Y2) +
3    $        (-14476.*(X4-6.*X2*Y2+Y4) +
```

```
3     $          429.*(X8-28.*X6*Y2+70.*X4*Y4-28.*X2*Y6+Y8))/319424.
3      RETURN
3      END
-----------------------------------------------------------------------
'EOR
'EOF
**************
* PROBLEM  35 *
**************
'EOR
*PARAMETER SET   1(A=0.0)
*          009.11     002.00     000.10     006.50
*          2022021202000
1          TWO DIMENSIONS $ CONSTANT COEFFICIENTS $ POISSON
1          LAPLACE
1          UXX$ + UYY$ = 0.
2          DIRICHLET
2          X=-1. , U=TRUE(X,Y)
2          X= 1. , U=TRUE(X,Y)
2          Y=-1. , U=TRUE(X,Y)
2          Y= 1. , U=TRUE(X,Y)
3      FUNCTION TRUE(X,Y)
3      X2 = X*X
3      X4 = X2*X2
3      X6 = X4*X2
3      X8 = X6*X2
3      Y2 = Y*Y
3      Y4 = Y2*Y2
3      Y6 = Y4*Y2
3      Y8 = Y6*Y2
3      U1 = X4 - 6.*X2*Y2 + Y4
3      U2 = X8 - 28.*X6*Y2 + 70.*X4*Y4 - 28.*X2*Y6 + Y8
3      TRUE = 1.1786 - .1801*U1 + .006*U2
3      RETURN
3      END
-
'EOR
*PARAMETER SET   2(A=0.1)
*          009.11     000.00     000.10     006.50
EXPAND 35/0.1/
'EOR
*PARAMETER SET   3(A=1.0)
*          009.11     000.00     000.10     006.50
EXPAND 35/1.0/
'EOR
*PARAMETER SET   4(A=10.)
*          009.11     000.00     000.10     006.50
EXPAND 35/10./
-----------------------------------------------------------------------
'EOR
'EOF
**************
* PROBLEM  36 *
**************
'EOR
*PARAMETER SET   1(A=0.0, B=0.0)
*          003.23     093.80     000.00     006.05
EXPAND 36/0.0,0.0/
'EOR
*PARAMETER SET   2(A=0.1, B=-0.5)
*          006.23     090.25     000.00     010.15
EXPAND 36/0.1,-0.5/
'EOR
*PARAMETER SET   3(A=0.0, B=1.0)
*          007.43     100.45     000.00     100.50
EXPAND 36/0.0,1.0/
'EOR
*PARAMETER SET   4(A=0.5, B=0.0)
*          003.20     090.35     000.00     005.00
EXPAND 36/0.5,0.0/
-----------------------------------------------------------------------
'EOR
'EOF
**************
* PROBLEM  37 *
**************
```

```
'EOR
*
*         008.07    010.20    000.00    002.10
*         2000000022000
1         TWO DIMENSIONS
1         A(X,Y)UXX$ + B(X,Y)UXY$ + C(X,Y)UYY$ = F(X,Y)
2         DIRICHLET
2         X=0. , U=TRUE(X,Y)
2         X=1. , U=TRUE(X,Y)
2         Y=0. , U=TRUE(X,Y)
2         Y=1. , U=TRUE(X,Y)
3     FUNCTION A(X,Y)
3     A = 1. + TRUEX(X,Y)**2
3     RETURN
3     END
3     FUNCTION B(X,Y)
3     B = -2.*TRUEX(X,Y)*TRUEY(X,Y)
3     RETURN
3     END
3     FUNCTION C(X,Y)
3     C = 1. + TRUEY(X,Y)**2
3     RETURN
3     END
3     FUNCTION TRUEX(X,Y)
3     TRUEX = (2.*(X-3.*Y) + (X-3.*Y)**2)*EXP(X-Y)
3     RETURN
3     END
3     FUNCTION TRUEY(X,Y)
3     TRUEY = (-6.*(X-3.*Y) - (X-3.*Y)**2)*EXP(X-Y)
3     RETURN
3     END
3     FUNCTION F(X,Y)
3     EXMY= EXP(X-Y)
3     XM3Y= X-3.*Y
3     UXX = (2. + 4.*XM3Y + XM3Y**2)*EXMY
3     UXY = (-6. - 8.*XM3Y - XM3Y**2)*EXMY
3     UYY = (18. + 12.*XM3Y + XM3Y**2)*EXMY
3     F = A(X,Y)*UXX+B(X,Y)*UXY+C(X,Y)*UYY
3     RETURN
3     END
3     FUNCTION TRUE(X,Y)
3     TRUE = (X-3.*Y)**2*EXP(X-Y)
3     RETURN
3     END
-------------------------------------------------------------------------
'EOR
'EOF
***************
* PROBLEM  38 *
***************
'EOR
*PARAMETER SET   1(A=1.0)
*         000.09    000.00    000.20    008.25
EXPAND 38/1.0/
'EOR
*PARAMETER SET   2(A=3.0)
*         000.13    000.00    000.30    010.40
EXPAND 38/3.0/
'EOR
*PARAMETER SET   3(A=7.0)
*         000.23    000.00    000.60    015.80
EXPAND 38/7.0/
-------------------------------------------------------------------------
'EOR
'EOF
***************
* PROBLEM  39 *
***************
'EOR
*PARAMETER SET   1(B=0.50, H(X)=1/X)
*         005.23    090.10    000.00    010.25
EXPAND 33/1,0.50/
'EOR
*PARAMETER SET   2(B=1.00, H(X)=1/X)
*         005.22    090.10    000.00    010.20
EXPAND 33/2,1.00/
```

```
'EOR
*PARAMETER SET   3(B=0.25, H(X)=EXP(X))
*          005.05    010.02    000.00    010.10
EXPAND 39/3,0.25/
'EOR
*PARAMETER SET   4(B=0.50, H(X)=EXP(X))
*          005.05    010.02    000.00    010.10
EXPAND 39/4,0.50/
'EOR
*PARAMETER SET   5(B=1.00, H(X)=EXP(X))
*          005.05    010.02    000.00    010.10
EXPAND 39/5,1.00/
-------------------------------------------------------------------------------
'EOR
'EOF
***************
* PROBLEM  40 *
***************
'EOR
*PARAMETER SET   1(A=0.5, B=0.5)
*          000.10    010.08    010.08    015.10
EXPAND 40/0.5,0.5/
'EOR
*PARAMETER SET   2(A=0.15, B=0.85)
*          000.13    010.08    025.10    015.10
EXPAND 40/0.15,0.85/
'EOR
*PARAMETER SET   3(A=0.85, B=0.15)
*          000.09    010.08    005.08    015.10
EXPAND 40/0.85,0.15/
-------------------------------------------------------------------------------
'EOR
'EOF
***************
* PROBLEM  41 *
***************
'EOR
*PARAMETER SET   1(A=-10.0, B=5)
*          000.02    002.02    000.00    006.04
EXPAND 41/-10.0,5/
'EOR
*PARAMETER SET   2(A=1.0, B=10)
*          000.02    002.02    000.00    006.04
EXPAND 41/1.0,10/
'EOR
*PARAMETER SET   3(A=-10.0, B=25)
*          000.02    002.02    000.00    006.04
EXPAND 41/-10.0,25/
-------------------------------------------------------------------------------
'EOR
'EOF
****************
* PROBLEM  42 *
****************
'EOR
*PARAMETER SET   1(A=0.0, B=1.0, C=1.0)
*          000.04    000.00    000.02    010.10
EXPAND 42/0.0,1.0,1.0/
'EOR
*PARAMETER SET   2(A=-1.0, B=2.0, C=2.0)
*          000.05    000.00    000.05    010.15
EXPAND 42/-1.0,2.0,2.0/
'EOR
*PARAMETER SET   3(A=-1.0, B=2.0, C=5.0)
*          000.08    000.00    000.10    010.30
EXPAND 42/-1.0,2.0,5.0/
-------------------------------------------------------------------------------
'EOR
'EOF
***************
* PROBLEM  43 *
***************
'EOR
*
*          000.02    000.00    000.00    006.04
*          20002202000020
```

```
1          TWO DIMENSIONS $ CONSTANT COEFFICIENTS  $ HOMOGENEOUS
1          UXX$ + UYY$ + UX$ = 0.
2          MIXED
2          X=0. ,                    U=0.
2          X=3.14159265358979 , MIXED = (1.)U + (-1.)UY = G(Y)
2          Y=0. ,                    U=0.
2          Y=3.14159265358979 , U=0.
3      FUNCTION TRUE(X,Y)
3      DATA PI, S502/3.14159265358979, 1.11803398875/
3      TRUE = EXP((PI-X)/2.)*SINH(S502*X)*SIN(Y)/SINH(S502*PI)
3      RETURN
3      END
3      FUNCTION SINH(X)
3      EXPX = EXP(X)
3      SINH = 0.5*(EXPX-1./EXPX)
3      RETURN
3      END
3      FUNCTION G(Y)
3      G = SIN(Y) - COS(Y)
3      RETURN
3      END
```

```
'EOR
'EOF
***************
* PROBLEM  44 *
***************
'EOR
*PARAMETER SET   1(A=1.425, B=1, C=.50, D=2)
*          008.03    010.03    000.00    005.02
EXPAND 44/1.425,1,.50,2,1/
'EOR
*PARAMETER SET   2(A=10.0, B=1, C=.50, D=2)
*          008.03    010.03    000.00    005.02
EXPAND 44/10.0,1,.50,2,2/
'EOR
*PARAMETER SET   3(A=1.425, B=2, C=.04, D=25)
*          008.02    010.03    000.00    000.00
EXPAND 44/1.425,2,.04,25,3/
'EOR
*PARAMETER SET   4(A=1.425, B=2, C=.50, D=2)
*          008.02    010.03    000.00    000.00
EXPAND 44/1.425,2,.50,2,4/
```

```
'EOR
'EOF
***************
* PROBLEM  45 *
***************
'EOR
*PARAMETER SET   1(A=2, B=1)
*          008.03    008.03    005.00    000.00
EXPAND 45/2.,1,1/
'EOR
*PARAMETER SET   2(A=1000, B=1)
*          008.14    008.03    005.00    010.60
EXPAND 45/1000.,1,2/
'EOR
*PARAMETER SET   3(A=2, B=2)
*          008.03    008.03    005.00    000.00
EXPAND 45/2.,2,3/
```

```
'EOR
'EOF
***************
* PROBLEM  46 *
***************
'EOR
*PARAMETER SET   1(A=1., B=2.)
*          008.05    000.00    000.00    010.20
EXPAND 46/1.,2.,1/
'EOR
*PARAMETER SET   2(A=4., B=2.)
*          008.06    000.00    000.00    010.25
EXPAND 46/4.,2.,2/
'EOR
```

```
*PARAMETER SET   3(A=1., B=10.)
*          008.07    010.00    000.00    010.30
EXPAND 46 4.,10.,3/
'EOR
*PARAMETER SET   4(A=3., B=2.)
*          008.03    000.00    000.00    010.37
EXPAND 46 3.,2.,4/
-------------------------------------------------------------------------
'EOR
'EOF
**************
* PROBLEM  47 *
**************
'EOR
*PARAMETER SET   1(A=3.0)
*          000.44    090.60    000.10    070.35
EXPAND 47/3./
'EOR
*PARAMETER SET   2(A=5.0)
*          000.34    080.50    000.00    060.15
EXPAND 47/5./
'EOR
*PARAMETER SET   3(A=7.0)
*          000.27    070.30    000.00    050.10
EXPAND 47/7./
-------------------------------------------------------------------------
'EOR
'EOF
**************
* PROBLEM  48 *
**************
'EOR
*PARAMETER SET   1(A=2, B=.04, C=1)
*          008.03    010.03    000.00    005.02
EXPAND 48/2,.04,1,1/
'EOR
*PARAMETER SET   2(A=25, B=.04, C=1)
*          008.04    010.03    000.00    005.04
EXPAND 48/25,0.04,1,2/
'EOR
*PARAMETER SET   3(A=2, B=.04, C=2)
*          008.04    010.03    000.00    005.04
EXPAND 48/2,.04,2,3/
'EOR
*PARAMETER SET   4(A=25, B=.04, C=2)
*          008.04    010.03    000.00    005.04
EXPAND 48/25,.04,2,4/
'EOR
*PARAMETER SET   5(A=2, B=.50, C=2)
*          008.04    010.03    000.00    005.04
EXPAND 48/2,.50,2,5/
-------------------------------------------------------------------------
'EOR
'EOF
**************
* PROBLEM  49 *
**************
'EOR
*PARAMETER SET   1(A=1, B=.50, C=2)
*          008.04    010.03    000.00    005.04
EXPAND 49/1,.50,2,1/
'EOR
*PARAMETER SET   2(A=1, B=.50, C=25)
*          008.14    010.03    000.00    020.50
EXPAND 49/1,.50,25,2/
'EOR
*PARAMETER SET   3(A=2, B=.04, C=2)
*          008.02    010.03    000.00    000.00
EXPAND 49/2,.04,2,3/
'EOR
*PARAMETER SET   4(A=2, B=.50, C=2)
*          008.02    010.03    000.00    000.00
EXPAND 49/2,.50,2,4/
-------------------------------------------------------------------------
'EOR
'EOF
```

```
***************
* PROBLEM  50 *
***************
'EOR
*
*         000.06    000.00    000.00    010.25
*         2022021202000
1         TWO DIMENSIONS $ CONSTANT COEFFICIENTS $ HOMOGENEOUS
1         POISSON $ LAPLACE
1         UXX$ + UYY$ = 0.
2         DIRICHLET
2         X=0. ,                U=SIN(3.14159265358979*Y)
2         X=3.14159265358979 ,  U=0.
2         Y=0. ,                U=0.75*SIN(X)-SIN(3.*X)
2         Y=1. ,                U=0.
3     FUNCTION TRUE(X,Y)
3     DATA PI/3.14159265358979/
3     T1 = 3.*SINH(1.-Y)*SIN(X)/(4.*SINH(1.))
3     T2 = SINH(3.*(1.-Y))*SIN(3.*X)/SINH(3.)
3     T3 = SINH(PI*(PI-X))*SIN(PI*Y)/SINH(PI*PI)
3     TRUE = T1 - T2 + T3
3     RETURN
3     END
3     FUNCTION SINH(X)
3     EXPX = EXP(X)
3     SINH = 0.5*(EXPX-1./EXPX)
3     RETURN
3     END
-------------------------------------------------------------------------------
'EOR
'EOF
***************
* PROBLEM  51 *
***************
'EOR
*PARAMETER SET   1(A=0.3)
*         009.38    100.05    090.05    010.15
EXPAND 51/0.3,1/
'EOR
*PARAMETER SET   2(A=0.5)
*         009.37    100.05    090.05    010.10
EXPAND 51/0.5,2/
'EOR
*PARAMETER SET   3(A=0.6)
*         009.36    100.05    090.05    010.05
EXPAND 51/0.6,3/
'EOR
*PARAMETER SET   4(A=0.7)
*         009.36    100.05    090.05    010.05
EXPAND 51/0.7,4/
-------------------------------------------------------------------------------
'EOR
'EOF
***************
* PROBLEM  52 *
***************
'EOR
*PARAMETER SET   1(A=2.)
*         008.06    010.05    005.00    010.05
EXPAND 52/2.,1/
'EOR
*PARAMETER SET   2(A=4.)
*         008.07    010.07    005.00    015.07
EXPAND 52/4.,2/
'EOR
*PARAMETER SET   3(A=43.)
*         008.15    010.25    005.00    015.35
EXPAND 52/43.,3/
-------------------------------------------------------------------------------
'EOR
'EOF
***************
* PROBLEM  53 *
***************
'EOR
*PARAMETER SET   1(A=30.0, B=20.0)
```

```
*          000.19    020.00    000.00    005.30
EXPAND 53/30.,PI./
'EOR
*PARAMETER SET   2(A=10.0, B=PI)
*          000.12    006.30    000.00    006.30
EXPAND 53/10.,3.14159265358979/
'EOR
*PARAMETER SET   3(A=10.0, B=10.0)
*          000.12    006.30    000.00    006.30
EXPAND 53/10.,10./
'EOR
*PARAMETER SET   4(A=20.0, B=10.0)
*          000.27    006.75    000.00    006.75
EXPAND 53/30.,10./
-------------------------------------------------------------------------------
'EOR
'EOF
**************
* PROBLEM  54 *
**************
'EOR
*PARAMETER SET   1(A=0.5)
*          000.09    010.05    000.10    010.20
EXPAND 54/.5/
'EOR
*PARAMETER SET   2(A=0.9)
*          000.17    010.20    000.25    015.30
EXPAND 54/0.9/
-------------------------------------------------------------------------------
'EOR
'EOF
**************
* PROBLEM  55 *
**************
'EOR
*PARAMETER SET   1(A=1., B=3., C=1)
*          008.13    000.00    005.20    020.35
EXPAND 55/1.,3.,1,1/
'EOR
*PARAMETER SET   2(A=3., B=2., C=1)
*          008.12    000.00    005.20    013.35
EXPAND 55/3.,2.,1,2/
'EOR
*PARAMETER SET   3(A=1., B=3., C=2)
*          008.15    000.00    005.20    027.40
EXPAND 55/1.,3.,2,3/
'EOR
*PARAMETER SET   4(A=6., B=2., C=2)
*          008.07    000.00    005.20    005.10
EXPAND 55/6.,2.,2,4/
-------------------------------------------------------------------------------
'EOR
'EOF
**************
* PROBLEM  56 *
**************
'EOR
*PARAMETER SET   1(A=0, B=1)
*          050.53    100.80    030.35    050.25
EXPAND 56/0,1/
'EOR
*PARAMETER SET   2(A=0, B=4)
*          050.58    100.80    030.45    050.40
EXPAND 56/0,4/
'EOR
*PARAMETER SET   3(A=3, B=1)
*          050.53    100.80    030.35    050.25
EXPAND 56/3,1/
'EOR
*PARAMETER SET   4(A=3, B=4)
*          050.53    100.80    030.45    050.40
EXPAND 56/3,4/
'EOR
*PARAMETER SET   5(A=3, B=8)
*          050.53    100.30    030.45    050.45
EXPAND 56/3,8/
```

```
$
'EOR
'EOF
```

ELLPACK PDE POPULATION MACRO FILE

MACFIL

MACFIL CONTAINS THE INFORMATION NEEDED TO FULFILL THE MACRO CALLS ORIGINATING IN EQNFIL.

MACFIL IS DIVIDED UP INTO RECORDS WHICH ARE NUMBERED 0, 1, 2,... ETC. THE END-OF-RECORD IS DESIGNATED BY #EOR ('EOR ON NON-CDC INSTALLATIONS).

RECORD 0 CONTAINS A DESCRIPTION OF THE PURPOSE AND ORGANIZATION OF MACFIL. RECORDS 1, 2, 3... CONTAIN THE INFORMATION NEEDED TO GENERATE THE ELLPACK PROGRAMS CORRESPONDING TO PROBLEMS 1, 2, 3... OF THE ELLPACK PDE POPULATION. ALTHOUGH SOME OF THE PROBLEMS ARE NOT PARAMETERIZED AND HENCE HAVE NO MACRO CALLS, YET, THERE ARE DUMMY RECORDS FOR THESE PROBLEMS ON MACFIL SO THAT THE PROBLEM AND MACRO NUMBERS MAY BE IN A ONE-TO-ONE CORRESPONDENCE. RECORDS 1, 2, 3... HAVE THE FOLLOWING FORMAT:

LINES 1-3: LINES 1 THROUGH 3 CONTAIN THE MACRO NUMBER.

LINE 4: LINE 4 CONTAINS THE PROBLEM TYPE INFORMATION STARTING IN COLUMN 11 WHICH IS USED TO TEST THE COMPATIBILIY OF THE PROBLEM WITH THE ELLPACK ROUTINES SELECTED IN THE ENCODED PROGRAM (SEE ROUTINE COMPAT). THIS INFORMATION BECOMES A COMMENT IN THE GENERATED ELLPACK PROGRAM.

COMPAT USES THE PROBLEM TYPE INFO (PTYPE) AND DISRETIZATION MODULE INFO (DMTYPE) TO DETERMINE WHETHER MODULE DISMOD IS COMPATIBLE WITH THE GIVEN PDE PROBLEM. THE NRTYPE (NOW 15) ITEMS IN THE ARRAY PTYPE AND IN EACH ROW OF THE TABLE DMTYPE HAVE THE FOLLOWING MEANINGS:

VALUE	PTYPE MEANING	DMTYPE MEANING
0	ITEM NOT PRESENT	ITEM MUST NOT BE PRESENT
1	ALWAYS MATCHES	ALWAYS MATCHES
2	ITEM PRESENT	ITEM MUST BE PRESENT

THE 14 ITEMS CURRENTLY CHECKED FOR COMPATIBILITY ARE:

CONCERNING THE OPERATOR
- 1 TWO DIMENSIONAL
- 2 THREE DIMENSIONAL
- 3 POISSON EQUATION
- 4 LAPLACE EQUATION
- 5 UX OR UY TERMS
- 6 CONSTANT COEFFICIENTS
- 7 SELF-ADJOINT FORM
- 8 NONSEPARABLE
- 9 UXY TERM

CONCERNING THE BOUNDARY CONDITIONS
- 10 DIRICHLET PROBLEM
- 11 SOME MIXED OR NATURAL CONDITIONS
- 12 GOVERNING CONDITIONS
- 13 NONSEPARABLE

CONCERNING THE GRID
- 14 RECTANGLE
- 15 UNIFORM GRID

ATMOSPHERIC LINES: THE REMAINING LINES OF THE RECORD CONTAIN [illegible] PROBLEM AND FORTRAN SEGMENTS OF THE [illegible] PROGRAM IN THE APPLE ORDER. [illegible] PROBLEM IS FOLLOWED BY A 1, 2 OR 3 [illegible] MORE THAN ONE PROBLEM MODE SHOULD [illegible] PROBLEM FORTRAN COMMENT CAN BE

WRITTEN BY TYPING A C IN COLUMN 2. FOR PORTABILITY PURPOSES, THE END-OF-RECORD IS DETECTED BY THE PRESENCE OF A '-' (DASH) IN COLUMN 1.

RELATED FILES: GENPGM, EONFIL, OPTFIL, GRDFIL, OUTFIL AND MODATA

```
'EOR
************
* MACRO   1 *
************
*         2000002000020
1         TWO DIMENSIONS $ SELF-ADJOINT
1         EXP(X*Y)UXX$ + EXP(-X*Y)UYY$ - 1./(1.+X+Y)U$ = F(X,Y)
2         MIXED
2         X=0. , MIXED = (1.)U + (-(&A))UX = GX0(Y)
2         X=1. , MIXED = (1.)U +  ( &A )UX = GX1(Y)
2         Y=0. , MIXED = (1.)U + (-(&A))UY = GY0(X)
2         Y=1. , MIXED = (1.)U +  ( &A )UY = GY1(X)
3     FUNCTION TRUE(X,Y)
3     COMMON /CONCOM/ PI
3     DATA PI/3.14159265358979/
3     TRUE = .75*EXP(X*Y)*SIN(PI*X)*SIN(PI*Y)
3     RETURN
3     END
3     FUNCTION F(X,Y)
3     COMMON /CONCOM/ PI
3     PX = PI*X
3     PY = PI*Y
3     SPX = SIN(PX)
3     SPY = SIN(PY)
3     EXY = EXP(X*Y)
3     F = .75*(EXY*EXY*SPY*((2.*Y*Y-PI*PI)*SPX+3.*PI*Y*COS(PX))+
3    $    PI*SPX*(X*COS(PY)-PI*SPY)-EXY*SPX*SPY/(1.+X+Y))
3     RETURN
3     END
3     FUNCTION GX0(Y)
3     COMMON /CONCOM/ PI
3     GX0 = -(&A)*PI*.75*SIN(PI*Y)
3     RETURN
3     END
3     FUNCTION GX1(Y)
3     COMMON /CONCOM/ PI
3     GX1 = -(&A)*PI*.75*EXP(Y)*SIN(PI*Y)
3     RETURN
3     END
3     FUNCTION GY0(X)
3     COMMON /CONCOM/ PI
3     GY0 = -(&A)*PI*.75*SIN(PI*X)
3     RETURN
3     END
3     FUNCTION GY1(X)
3     COMMON /CONCOM/ PI
3     GY1 = -(&A)*PI*.75*EXP(X)*SIN(PI*X)
3     RETURN
3     END
3     FUNCTION CDXU(X,Y)
3     CDXU = Y*EXP(X*Y)
3     RETURN
3     END
3     FUNCTION CDYU(X,Y)
3     CDYU = -X*EXP(-X*Y)
3     RETURN
3     END
```

```
'EOR
************
* MACRO   2 *
************
```

```
'EOR
************
* MACRO   3 *
************
*         2020021002002
1         TWO DIMENSIONS  $  CONSTANT COEFFICIENTS  $  POISSON
```

```
1         UXX$ + UYY$ = F(X,Y)
2         DIRICHLET $ HOMOGENEOUS
2         X=0. , U=0.
2         X=1. , U=0.
2         Y=0. , U=0.
2         Y=1. , U=0.
3     FUNCTION TRUE(X,Y)
3     COMMON /CONCOM/ C,CAA1,AM2,INITL
3     DATA INITL/1/
3     IF (INITL .EQ. 0)  GO TO 10
3        C = 1./((&A)**((&A)/(1.-(&A)))
3    $           -(&A)**(1./(1.-(&A))))**2
3        CAA1 = C*(&A)*((&A)-1.)
3        AM2 = &A-2.
3        INITL = 0
3  10 CONTINUE
3     TRUE = C*(X**(&A)-X)*(Y**(&A)-Y)
3     RETURN
3     END
3     FUNCTION F(X,Y)
3     COMMON /CONCOM/ C,CAA1,AM2,INITL
3     IF (INITL .EQ. 0)  GO TO 10
3        C = 1./((&A)**((&A)/(1.-(&A)))
3    $           -(&A)**(1./(1.-(&A))))**2
3        CAA1 = C*(&A)*((&A)-1.)
3        AM2  = &A-2.
3        INITL = 0
3  10 CONTINUE
3     IF ( X.EQ.0. .OR. Y.EQ.0. ) GO TO 20
3        F = CAA1*(X**AM2*(Y**(&A)-Y) +
3    $             Y**AM2*(X**(&A)-X)   )
3     RETURN
3  20 F = 0.
3     RETURN
3     END
```

```
'EOR
**************
* MACRO   4 *
**************
*         2020021000020
1         TWO DIMENSIONS $ CONSTANT COEFFICIENTS $ POISSON
1         UXX$ + UYY$ = 6.*X*Y*EXP(X+Y)*(X*Y+X+Y-3.)
2         MIXED
2         X=0. , MIXED = (1.)U + (-(&A)*(Y-Y*Y))UX = G(Y)
2         X=1. , U=0.
2         Y=0. , U=0.
2         Y=1. , U=0.
3     FUNCTION TRUE(X,Y)
3     TRUE = 3.*EXP(X+Y)*X*Y*(1.-X)*(1.-Y)
3     RETURN
3     END
3     FUNCTION G(Y)
3     TEMP = (Y-Y*Y)**2
3     G  = -(&A)*TEMP*3.*EXP(Y)
3     RETURN
3     END
```

```
'EOR
**************
* MACRO   5 *
**************
*         2000021002002
1         TWO DIMENSIONS $ CONSTANT COEFFICIENTS
1         4.UXX$ + UYY$ - (&A)U$ = F(X,Y)
2         DIRICHLET $ HOMOGENEOUS
2         X=0. , U=0.
2         X=1. , U=0.
2         Y=0. , U=0.
2         Y=1. , U=0.
3     FUNCTION TRUE(X,Y)
3     COMMON /CONCOM/ TWOPI
3     DATA TWOPI/6.28316530717958/
3     TRUE = 2.*X*(X-1.)*(COS(TWOPI*Y)-1.)
3     RETURN
3     END
```

```
3      FUNCTION F(X,Y)
3      COMMON /CONCOM/ TWOPI
3      CTPY = COS(TWOPI*Y)
3      F = 2.*X*(X-1.)*(&A*(1.-CTPY)-TWOPI*TWOPI*CTPY)
3     $     + 15.*(CTPY-1.)
3      RETURN
3      END
```

```
'EOR
**************
* MACRO   6 *
**************
```

```
'EOR
**************
* MACRO   7 *
**************
```

```
'EOR
**************
* MACRO   8 *
**************
*          2020021002000
1          TWO DIMENSIONS $ CONSTANT COEFFICIENTS $ POISSON
1          UXXS + UYYS = D2P(X)*P(Y)+P(X)*D2P(Y)
2          DIRICHLET
2          X=0. , U=TRUE(X,Y)
2          X=1. , U=TRUE(X,Y)
2          Y=0. , U=TRUE(X,Y)
2          Y=1. , U=TRUE(X,Y)
3      FUNCTION TRUE(X,Y)
3      TRUE = P(X)*P(Y)
3      RETURN
3      END
3      FUNCTION P(X)
3      COMMON /CONCOM/ A,B
3      DATA A, B/1., 0./
3      X1 = &A
3      X2 = 1. - (&A)
3      IF (X .LT. X1) GO TO 1
3      IF (X .GT. X2) GO TO 2
3      DPHI = B - A
3      DX = X2 - X1
3      P = A + DPHI*(X-X1)**3/(DX**3)-3.*DPHI*(X-X1)**3*(X-X2)
3     $     /DX**4 + 6.*DPHI*(X-X1)**3*(X-X2)**2/DX**5
3      RETURN
3    1 P = A
3      RETURN
3    2 P = B
3      RETURN
3      END
3      FUNCTION D2P(X)
3      COMMON /CONCOM/ A,B
3      X1 = &A
3      X2 = 1. - (&A)
3      IF (X .LT. X1) GO TO 1
3      IF (X .GT. X2) GO TO 1
3      DPHI = B - A
3      DX = X2 - X1
3      C3 = DPHI/DX**3
3      C4 = -3.*DPHI/DX**4
3      C5 = 6.*DPHI/DX**5
3      D2P = 6.*C3*(X-X1)+6.*C4*(X-X1)*(X-X2)+
3     $       6.*C4*(X-X1)**2+6.*C5*(X-X1)*(X-X2)**2+
3     $       12.*C5*(X-X1)**2*(X-X2)+2.*C5*(X-X1)**3
3      RETURN
3    1 D2P = 0.
3      RETURN
3      END
```

```
'EOR
**************
* MACRO   9 *
**************
*          2020020002000
1          TWO DIMENSIONS $ CONSTANT COEFFICIENTS
```

```
1          UXX$ + UYY$ - 100.U$ = .5*(&A**2-100.)*COSH(&A*Y)/COSH(&A)
2          DIRICHLET
2          X=0. , U=TRUE(X,Y)
2          X=1. , U=TRUE(X,Y)
2          Y=0. , U=TRUE(X,Y)
2          Y=1. , U=TRUE(X,Y)
3      FUNCTION TRUE(X,Y)
3      TRUE = .5*(COSH(10.*Y)/COSH(10.)+COSH(&A*Y)/COSH(&A))
3      RETURN
3      END
3      FUNCTION COSH(Z)
3      EXPZ = EXP(Z)
3      COSH = 0.5*(EXPZ+1./EXPZ)
3      RETURN
3      END
-------------------------------------------------------------------------------
'EOR
**************
* MACRO  10 *
**************
*          2020021002002
1          TWO DIMENSIONS  $  CONSTANT COEFFICIENTS  $  POISSON
1          UXX$ + UYY$ = F(X,Y)
2          DIRICHLET $ HOMOGENEOUS
2          X=0. , U=0.
2          X=1. , U=0.
2          Y=0. , U=0.
2          Y=1. , U=0.
3      FUNCTION TRUE(X,Y)
3      U =  &A*((X-.5)**2+(Y-(&B))**2)
3      TRUE = EXP(U)*X*(X-1.)*Y*(Y-1.)
3      RETURN
3      END
3      FUNCTION F(X,Y)
3      TEMP = EXP(-&A*((X-.5)**2+(Y-(&B))**2))
3      UXX = TEMP*Y*(Y-1.)*(-2.*&A*(X-.5)*
3     $       (-2.*&A*X**3+3.*&A*X**2+(2.-&A)*X-1.)+
3     $       (-6.*&A*X**2+6.*&A*X+(2.-&A)))
3      UYY = TEMP*X*(X-1.)*(-2.*&A*(Y-&B)*
3     $       (-2*&A*Y**3+2.*&A*(1.+&B)*Y**2+
3     $       2.*(1.-&A*&B)*Y-1.)+(-6.*&A*Y**2+
3     $       4.*&A*(1.+&B)*Y+2.*(1.-&A*&B)))
3      F = UXX + UYY
3      RETURN
3      END
-------------------------------------------------------------------------------
'EOR
**************
* MACRO  11 *
**************
*          2020021002000
1          TWO DIMENSIONS  $  CONSTANT COEFFICIENTS  $  POISSON
1          UXX$ + UYY$ = F(X,Y)
2          DIRICHLET
2          X=0. , U=TRUE(X,Y)
2          X=1. , U=TRUE(X,Y)
2          Y=0. , U=TRUE(X,Y)
2          Y=1. , U=TRUE(X,Y)
3      FUNCTION TRUE(X,Y)
3      COMMON /CONCOM/ PI
3      DATA PI/3.14159265358979/
3      TEMP = X-Y**2.
3      TEMP4 = TEMP**4
3      TRUE = SIN(&A*TEMP4*TEMP/(1.+TEMP4))
3      RETURN
3      END
3      FUNCTION F(X,Y)
3      COMMON /CONCOM/ PI
3      U = X-Y**2.
3      P = (&A*6
3      S = 1.+U**4
3      C = P/S
3      PP = -12.*U
3      SS = 6.*U**4
3      PPP = -24.*U**3
3      CC = 1.-U**2
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```
3      SXX = 12 *W**2
3      S2 = S*S
3      S3 = S2*S
3      UX = (S*RX-R*SX)/S2
3      UXX = (S2*RXX-R*S*SXX-2.*S*SX*RX+2.*R*SX**2)/S3
3      CAU = COS(AU)
3      SAU = SIN(AU)
3      UXX = (&A)*(CAU*UXX-(&A)*SAU*UX*UX)
3      F = 2.0*UXX
3      RETURN
3      END
-------------------------------------------------------------------------------
'EOR
*************
* MACRO  12 *
*************
*          2000200002000
1          TWO DIMENSIONS
1          UXX$ + UYY$ + (1.+SIN(&A*X))UX$
1.         - COS(&A*Y)U$ = F(X,Y)
2          DIRICHLET
2          X=0. , U=TRUE(X,Y)
2          X=1. , U=TRUE(X,Y)
2          Y=0. , U=TRUE(X,Y)
2          Y=1. , U=TRUE(X,Y)
3      FUNCTION TRUE(X,Y)
3      TRUE = COS(&B*Y)+SIN(&B*(X-Y))
3      RETURN
3      END
3      FUNCTION F(X,Y)
3      BXMY = &B*(X-Y)
3      UX = &B*COS(BXMY)
3      B2 = (&B)*(&B)
3      UXX = -B2*SIN(BXMY)
3      U = COS(&B*Y)+SIN(BXMY)
3      UYY = -B2*U
3      F = UXX + UYY + (1.+SIN(&A*X))*UX
3     $     - COS(&A*Y)*U
3      RETURN
3      END
-------------------------------------------------------------------------------
'EOR
*************
* MACRO  13 *
*************
-------------------------------------------------------------------------------
'EOR
*************
* MACRO  14 *
*************
*          2000220002000
1          CONSTANT COEFFICIENTS
1          UXX$ + 2.UYY$ + 3.UX$ - 4.UY$ - U$ = F(X,Y)
2          DIRICHLET
2          X=0. , U=Y
2          X=1. , U=TRUE(X,Y)
2          Y=0. , U=0.
2          Y=1. , U=1. - 0.8*(&A) + (&A)*ABS(X-0.8)
3      FUNCTION TRUE(X,Y)
3      TRUE = Y*(1.-.8*(&A)**(2.-Y)+(&A)*ABS(X-.8)**(2.-Y)) +
3     $        X*Y*EXP(-X*Y)
3     $        *(Y-1.)
3      RETURN
3      END
3      FUNCTION F(X,Y)
3      G = (2.-Y)*ALOG(ABS(X-.8))
3      P = 1.-.8*(&A)**(2.-Y) + (&A)*EXP(G)
3      DXG = (2.-Y)*G(X)/ABS(X-.8)
3      DXXG = -(2.-Y)*G(X)**2/(X-.8)**2
3      DYG = -ALOG(ABS(X-.8))
3      DYYG = 0.
3      DXP = &A*DXG*EXP(G)
3      DXXP = (&A)*DXXG*EXP(G)+(&A)*DXG**2*EXP(G)
3      DYP = .8*ALOG(&A)*EXP((2.-Y)*ALOG(&A)) +
3     $       (&A)*DYG*EXP(G)
3      DYYP = -.8*ALOG(&A)**2*EXP((2.-Y)*ALOG(&A))+
```

```
3     $      &A*DYYO*EXP(0)+&A*DYO**2*EXP(0)
3      U = Y*P + X*EXP(-X*Y)*(Y*Y-Y)
3      UX = Y*DXP + (1.-X*Y)*(Y*Y-Y)*EXP(-X*Y)
3      UXX = Y*DXXP-Y*(Y*Y-Y)*EXP(-X*Y)*(2.-X*Y)
3      UY = P + Y*DYP + X*EXP(-X*Y)*(2.*Y-1.-X*Y*(Y-1.))
3      UYY = 2.*DYP + Y*DYYP + X*EXP(-X*Y)*(2.-4.*X*Y+2.*X+
3     $       (X*Y)**2-X*X*Y)
3      F = UXX + 2.*UYY + 3.*UX -4.*UY - U
3      RETURN
3      END
3      FUNCTION G(Y)
3      G = 1.
3      IF ( Y .LE. .8 ) G = -1.
3      RETURN
3      END
```

```
'EOR
**************
* MACRO  15 *
**************
*          2000200002000
1          TWO DIMENSIONS
1          UXX$ + UYY$ + (&A)/(Y+(&C))UY$ = F(X,Y)
2          DIRICHLET
2          X=0. , U=TRUE(X,Y)
2          X=1. , U=TRUE(X,Y)
2          Y=0. , U=TRUE(X,Y)
2          Y=1. , U=TRUE(X,Y)
3      FUNCTION TRUE(X,Y)
3      TRUE = (Y**(&B) + COS(X*Y*Y)-1.)*X*X*(X-1.)**2
3      RETURN
3      END
3      FUNCTION F(X,Y)
3      F1 = Y**&B + COS(X*Y*Y) - 1.
3      DXF1 = -Y*Y*SIN(X*Y*Y)
3      DXXF1 = -Y**4*COS(X*Y*Y)
3      F2 = X*X*(X-1.)*(X-1.)
3      DXF2 = 4.*X**3 - 6.*X*X + 2.*X
3      DXXF2 = 12.*X*X - 12.*X + 2.
3      UX = DXF1*F2 + F1*DXF2
3      UXX = DXXF1*F2 + DXF1*DXF2 + DXF1*DXF2 + F1*DXXF2
3      DYF1 = &B*Y**(&B-1.)-2.0*X*Y*SIN(X*Y*Y)
3      DYYF1 = &B*(&B-1.)*Y**(&B-2.)-2.0*X*SIN(X*Y*Y)-
3     $        (2.0*X*Y)**2*COS(X*Y*Y)
3      UY = DYF1*F2
3      UYY = DYYF1*F2
3      F = UXX + UYY + (&A)/(Y+(&C))*UY
3      RETURN
3      END
```

```
'EOR
**************
* MACRO  16 *
**************
*          2000200002002
1          TWO DIMENSIONS
1          UXX$ + UYY$ + (500./(250.*Y-1.))UY$ = -1./&B**2
2          DIRICHLET $ HOMOGENEOUS
2          X=0. , U=0.
2          X=&B , U=0.
2          Y=0. , U=0.
2          Y=&B , U=0.
3      FUNCTION TRUE(X,Y)
3C
3C     ********************************************************
3C     *                                                      *
3C     *                  MACRO 16 PARAMETERS                 *
3C     *                                                      *
3C     ********************************************************
3C     *                                                      *
3C     *                        A  I   B                      *
3C     *                       -----I------                   *
3C     *                         1  I   1                     *
3C     *                            I                         *
3C     *                        10  I   2                     *
3C     *                                                      *
```

```
3C     ********************************************************************
3C
3       REAL DERVSL(6), TABLE(20,20), GRID1(20), GRID2(20),
3      $     T1B1(100), T1B2(100), T1B3(100), T1B4(100),
3      $     T2B1(100), T2B2(100), T2B3(100), T2B4(100)
3       EQUIVALENCE (TABLE(1, 1) , T&AB1(1)),
3      $             (TABLE(1, 6) , T&AB2(1)),
3      $             (TABLE(1,11) , T&AB3(1)),
3      $             (TABLE(1,16) , T&AB4(1))
3       DATA NGRID, NGRDD/20, 20/
3       DATA GRID1/0.0000000, 0.0526316, 0.1052632, 0.1578947,
3      $0.2105263, 0.2631579, 0.3157895, 0.3684211, 0.4210526,
3      $0.4736842, 0.5263158, 0.5789474, 0.6315789, 0.6842105,
3      $0.7368421, 0.7894737, 0.8421053, 0.8947368, 0.9473684,
3      $1.0000000/
3       DATA GRID2/0.0000000, 0.5163158, 1.0526316, 1.5789474,
3      $2.1052632, 2.6315789, 3.1578947, 3.6842105, 4.2105263,
3      $4.7368421, 5.2631579, 5.7894737, 6.3157895, 6.8421053,
3      $7.3684211, 7.8947368, 8.4210526, 8.9473684, 9.4736842,
3      $10.000000/
3C
3C      APPROXIMATE SOLUTION OF PROBLEM USING
3C      P3-C1 COLLOCATION (3 X 3 GRID)
3C
3       DATA T1B1/  .000000,  .000000,  .000000,  .000000,  .000000,
3      $  .000000,  .000000,  .000000,  .000000,  .000000,  .000000,
3      $  .000000,  .000000,  .000000,  .000000,  .000000,  .000000,
3      $  .000000,  .000000,  .000000,  .000000,  .437323,  .752189,
3      $  .845004,  .667101,  .268576, -.232316, -.885116,-1.349772,
3      $-1.614187,-1.614187,-1.349772, -.885116, -.232313,  .268576,
3      $  .667101,  .845004,  .752189,  .437323,  .000000,  .000000,
3      $  .137048,  .233351,  .270609,  .224243,  .112455, -.044762,
3      $ -.212208, -.351996, -.428204, -.428204, -.351996, -.212208,
3      $ -.044762,  .112455,  .224243,  .270609,  .233351,  .137048,
3      $  .000000,  .000000, -.003242, -.003557,  .003720,  .020941,
3      $  .045046,  .076174,  .106132,  .130279,  .143314,  .143314,
3      $  .130279,  .106132,  .076174,  .045046,  .020941,  .003720,
3      $ -.003557, -.003242,  .000000,  .000000,  .008386,  .019390,
3      $  .030544,  .044457,  .060368,  .077176,  .092789,  .104903,
3      $  .111355,  .111355,  .104903,  .092789,  .077176,  .060368,
3      $  .044457,  .030544,  .019330,  .008836,  .000000/
3C
3       DATA T1B2/  .000000,  .013971,  .026502,  .039743,  .051349,
3      $  .063396,  .076176,  .086342,  .094223,  .098016,  .098016,
3      $  .094323,  .086342,  .076176,  .063336,  .051349,  .039743,
3      $  .026502,  .013971,  .000000,  .000000,  .015353,  .029741,
3      $  .042343,  .054036,  .064900,  .074555,  .082534,  .088339,
3      $  .091393,  .091323,  .083333,  .082534,  .074555,  .064500,
3      $  .054036,  .042343,  .029741,  .015359,  .000000,  .000000,
3      $  .016673,  .031077,  .043366,  .054754,  .064370,  .072490,
3      $  .070019,  .083303,  .085335,  .085935,  .083333,  .078918,
3      $  .072190,  .064370,  .054754,  .043366,  .031077,  .016673,
3      $  .000000,  .000000,  .016733,  .031075,  .043377,  .053506,
3      $  .062765,  .068333,  .073547,  .072335,  .081251,  .081231,
3      $  .070335,  .075547,  .060935,  .052755,  .033305,  .043377,
3      $  .031075,  .016733,  .000000,  .000000,  .016475,  .030407,
3      $  .042367,  .052332,  .060523,  .067073,  .072004,  .075095,
3      $  .076551,  .076551,  .075305,  .072004,  .067076,  .060523,
3      $  .052332,  .042367,  .030407,  .019475,  .000000/
3C
3       DATA T1B3/  .000000,  .015338,  .028494,  .040772,  .050141,
3      $  .057737,  .063711,  .068146,  .071031,  .072546,  .072546,
3      $  .071031,  .068146,  .063711,  .057737,  .050141,  .040772,
3      $  [illegible], .015913,  .000000,  .000000,  .015271,  [illegible],
3      $  [illegible], [illegible], .054403,  .058340,  .033335,  .060459,
3      $  .057754,  .057754,  .063459,  .060336,  .058340,  .054403,
3      $  [illegible], .050793,  .033075,  .015271,  .000000,  .000000,
3      $  [illegible], [illegible], [illegible], .044137,  .050513,  [illegible],
3      $  [illegible], [illegible], [illegible], [illegible], .031275,  .058506,
3      $  [illegible], [illegible], [illegible], [illegible], .026379,  .014413,
3      $  [illegible], [illegible], [illegible], [illegible], .051253,  .040398,
3      $  [illegible], [illegible], [illegible], .050413,  .050415,  .050415,
3      $  [illegible], [illegible], [illegible], .013011,  .040393,  .037253,
3      $  [illegible], [illegible], .000000,  .000000,  .012155,  .021551,
3      $  .050703,  [illegible], .040105,  .044453,  .047035,  .048778,
3      $  .045014,  [illegible], .043773,  .047035,  .044453,  .040806,
```

```
3      $ .035203, .023722, .[illegible]1051, .012155, .000000/
 C
       DATA T13[illegible] .[illegible], .[illegible], .019113, .025712, .030659,
       $ .[illegible], .[illegible], .[illegible], .[illegible], .011913, .041913,
       $ .[illegible], .[illegible], .[illegible], .[illegible], .030353, .025712,
3      $ .010112, .[illegible], .[illegible], .[illegible], .000009, .015729,
       $ .[illegible], .[illegible], .[illegible], .[illegible], .031633, .032706,
3      $ .[illegible], .[illegible], .[illegible], .021333, .030104, .027871,
3      $ .024[illegible], .[illegible], .[illegible]729, .009[illegible], .000000, .000000,
3      $ .[illegible], .[illegible], .015191, .017273, .015370, .021347,
3      $ .022332, .023055, .022332, .020332, .023055, .022332,
3      $ .021347, .015370, .017273, .015191, .011652, .006821,
3      $ .000000, .000000, .004061, .006573, .008226, .009659,
3      $ .010837, .011357, .011365, .012167, .012345, .012345,
3      $ .012107, .011365, .011357, .010837, .009659, .008226,
3      $ .006573, .004061, .000000, .000000, .000000, .000000,
3      $ .000000, .000000, .000000, .000000, .000000, .000000,
3      $ .000000, .000000, .000000, .000000, .000000, .000000,
3      $ .000000, .000000, .000000, .000000, .000000/
3C
3      DATA T2D1/ .000000, .000000, .000000, .000000, .000000,
3      $ .000000, .000000, .000000, .000000, .000000, .000000,
3      $ .000000, .000000, .000000, .000000, .000000, .000000,
3      $ .000000, .000000, .000000, .000000, 1.335077, 2.627260,
3      $ 3.[illegible], 4.[illegible]913, 5.905559, 6.704992, 7.320325, 7.740846,
3      $ 7.[illegible], 7.[illegible], 7.730848, 7.320325, 6.704992, 5.905559,
3      $ 4.[illegible]913, 3.[illegible]1175, 2.627260, 1.335077, .000000, .000000,
3      $ .[illegible]1025, .[illegible], 1.[illegible], 1.704234, 2.035371, 2.310493,
3      $ 2.[illegible]111, 2.[illegible]250, 2.733333, 2.722333, 2.666250, 2.522111,
3      $ 2.[illegible], 2.[illegible]371, 1.704234, 1.325933, .907873, .461828,
3      $ .[illegible], .000000, .004144, .006349, .007212, .007204,
3      $ .[illegible], .[illegible], .005073, .004443, .004113, .004113,
3      $ .[illegible], .005073, .006366, .006350, .007204, .007212,
3      $ .[illegible]349, .004144, .000000, .000000, .009738, .017273,
3      $ .022310, .027114, .030140, .032266, .033690, .034547,
3      $ .034353, .034353, .034547, .033690, .032266, .030140,
3      $ .027114, .022319, .017273, .009738, .000000/
3C
3      DATA T3D2/ .000000, .012342, .023290, .030204, .036406,
3      $ .041151, .044930, .047169, .048744, .049517, .049517,
3      $ .048744, .047169, .044930, .041151, .036406, .030204,
3      $ .022230, .012342, .000000, .000000, .013329, .025208,
3      $ .[illegible], .041330, .047590, .051848, .055069, .057071,
3      $ .[illegible], .053013, .057071, .055069, .051848, .047590,
3      $ .[illegible], .031447, .023208, .013325, .000000, .000000,
3      $ .019365, .[illegible], .033334, .044335, .051231, .058050,
3      $ .[illegible], .061777, .062233, .062106, .061777, .059531,
3      $ .[illegible], .051231, .044335, .033334, .023343, .014895,
3      $ .000000, .000000, .015910, .027527, .037325, .046157,
3      $ .[illegible], .057767, .061402, .063752, .064913, .064913,
3      $ .[illegible], .061402, .057767, .052733, .046157, .037825,
3      $ .027527, .015910, .000000, .000000, .015044, .027595,
3      $ .[illegible], .[illegible], .[illegible], .037049, .051904, .066999,
3      $ .[illegible], .[illegible], .[illegible], .061904, .057943, .052594,
3      $ .[illegible], .[illegible], .[illegible], .015044, .000000/
3C
3      DATA T[illegible]/ .000000, .014916, .027148, .037279, .045459,
3      $ .[illegible], .[illegible], .[illegible], .[illegible], .[illegible], .052953,
3      $ .[illegible], .[illegible], .[illegible], .[illegible], .045459, .037276,
3      $ .[illegible], .[illegible], .[illegible], .000000, .014934, .028261,
3      $ .[illegible], .[illegible], .[illegible], .[illegible], .053033, .060220,
3      $ .[illegible], .[illegible], .[illegible], .[illegible], .054957, .042233,
3      $ .[illegible], .[illegible], .[illegible], .014934, .000000, .000000,
3      $ .016[illegible], .[illegible], .[illegible], .[illegible], .047161, .051503,
3      $ .[illegible], .[illegible], .[illegible], .[illegible], .[illegible], .054925,
3      $ .[illegible], .[illegible], .[illegible], .034[illegible]23, .024377, .013709,
3      $ .[illegible], .000000, .[illegible], .[illegible], .021671, .030727,
3      $ .[illegible], .[illegible], .[illegible], .051[illegible], .052330, .052860,
3      $ .[illegible], .[illegible], .[illegible], .[illegible], .030327, .031671,
3      $ .[illegible], .[illegible], .000000, .000000, .011754, .021157,
3      $ .[illegible], .[illegible], .[illegible], .042913, .044723, .048230,
3      $ .[illegible], .[illegible], .[illegible], .[illegible], .042319, .039049,
3      $ .[illegible], .[illegible], .[illegible], .011754, .000000/
3C
3      [illegible] .[illegible], .[illegible], .[illegible], .[illegible], .024037, .020750,
3      $ .[illegible], .[illegible], .[illegible], .[illegible], .[illegible], .040067,
```

```
3     $  .039452,  .033203,  .033241,  .033474,  .029760,  .024867,
3     $  .018546,  .010412,  .000000,  .000000,  .008743,  .015339,
3     $  .020326,  .024124,  .026958,  .029070,  .030554,  .031494,
3     $  .031956,  .031956,  .031494,  .030554,  .029070,  .026968,
3     $  .024124,  .020326,  .015339,  .008743,  .000000,  .000000,
3     $  .006701,  .011414,  .014841,  .017417,  .019320,  .020716,
3     $  .021608,  .022318,  .022623,  .022623,  .022318,  .021698,
3     $  .020716,  .019320,  .017417,  .014841,  .011414,  .006701,
3     $  .000000,  .000000,  .004005,  .006463,  .008163,  .009448,
3     $  .010383,  .011066,  .011545,  .011846,  .011994,  .011994,
3     $  .011846,  .011545,  .011066,  .010383,  .009448,  .008163,
3     $  .006463,  .004005,  .000000,  .000000,  .000000,  .000000,
3     $  .000000,  .000000,  .000000,  .000000,  .000000,  .000000,
3     $  .000000,  .000000,  .000000,  .000000,  .000000,  .000000,
3     $  .000000,  .000000,  .000000,  .000000,  .000000/
3C
3C    INTERPOLATE NUMERICAL SOLUTION BY QUADRATICS
3C
3     CALL QUADRD(X,Y,TABLE,GRID&A,GRID&A,NGRID,NGRID,NGRDD,NGRDD,
3    $            DERVSL)
3C
3     TRUE = DERVSL(6)
3C
3     RETURN
3     END
```

```
'EOR
*************
* MACRO  17 *
*************
*         2020021002000
1         TWO DIMENSIONS  $  CONSTANT COEFFICIENTS  $  POISSON
1         UXX$ + UYY$ = F(X,Y)
2         X=0. , U=TRUE(X,Y)
2         X=1. , U=TRUE(X,Y)
2         Y=0. , U=TRUE(X,Y)
2         Y=1. , U=TRUE(X,Y)
3     FUNCTION TRUE (X,Y)
3     COMMON /CONCOM/ A,B
3     DATA A,B /&A,&B/
3     BX3 = (B*X)**3
3     TRUE = SIN(X-Y+.5) + EXP(-Y*Y-(A*BX3/(1.+BX3))**2)
3     RETURN
3     END
3     FUNCTION F (X,Y)
3     COMMON /CONCOM/ A,B
3     BX  = (B*X)**3
3     DDH = 6.*X*B**3
3     DH = DDH*X/2.
3     H = 1. + DH*X/3.
3     G = A*(H-1.)
3     DG = A*DH
3     FE = G/H
3     DDG = A*DDH
3     DFE = DG/H - G*DH/(H**2)
3     DDFE = (H*DDG - 2.*DG*DH - G*DDH + 2.*G*DH*DH/H)/H**2
3     S = FE*FE
3     DS = 2.*FE*DFE
3     DDS = 2.*(FE*DDFE + DFE*DFE)
3     SINXY = SIN(X-Y+.5)
3     EE = EXP(-Y*Y-S)
3     UXX = -SINXY - EE*(DDS-DS*DS)
3     UYY = -SINXY - EE*2.*(1.-2.*Y*Y)
3     F = UXX + UYY
3     RETURN
3     END
```

```
'EOR
*************
* MACRO  18 *
*************
*         2000200002000
1         TWO DIMENSIONS
1         UXX$ + (1.+X*Y)UYY$ + COS(X)UX$ - EXP(-X)UY$ + 3.U$ = F(X,Y)
2         DIRICHLET
2         X=0. , U=TRUE(X,Y)
```

```
2          X=1. , U=TRUE(X,Y)
2          Y=0. , U=TRUE(X,Y)
2          Y=1. , U=TRUE(X,Y)
3      FUNCTION TRUE(X,Y)
3      COMMON /CONCOM/ A,B
3      DATA A,B /&A,&B/
3      BX3 = (B*X)**3
3      TRUE = EXP(-Y*Y-(A*BX3/(1.+BX3))**2)+SIN(X-Y+.5)
3      RETURN
3      END
3      FUNCTION F(X,Y)
3      COMMON /CONCOM/ A,B
3      BX  = (B*X)**3
3      DDH = 6.*X*B**3
3      DH = DDH*X/2.
3      H = 1. + DH*X/3.
3      G = A*(H-1.)
3      DG = A*DH
3      DDG = A*DDH
3      FE = G/H
3      DFE = DG/H - G*DH/(H**2)
3      DDFE = (H*DDG - 2.*DG*DH - G*DDH + 2.*G*DH*DH/H)/H**2
3      S = FE*FE
3      DS = 2.*FE*DFE
3      DDS = 2.*(FE*DDFE + DFE*DFE)
3      SINXY = SIN(X-Y+.5)
3      EE = EXP(-Y*Y-S)
3      UXX = -SINXY - EE*(DDS-DS*DS)
3      UYY = -SINXY - EE*2.*(1.-2.*Y*Y)
3      UX = -2.*DFE*FE*EE + COS(X-Y+.5)
3      UY = -2.*Y*EE - COS(X-Y+.5)
3      U  = TRUE(X,Y)
3      F = UXX + (1.+X*Y)*UYY + COS(X)*UX-EXP(-X)*UY+3.*U
3      RETURN
3      END
```

```
'***
*********
* [illegible]RO  19 *
**********
*          2000002000202
1          TWO DIMENSIONS $ SELF-ADJOINT
1          W(X,Y)UXX$ + W(X,Y)UYY$ = F(X,Y)
2          HOMOGENEOUS
2          X=0.5 , UX=0.
2          X=1.0 , U =0.
2          Y=0.5 , UY=0.
2          Y=1.0 , U =0.
3      FUNCTION W(X,Y)
3      COMMON /CONCOM/ PI
3      DATA PI/3.14159265358979/
3      W = ((PI*COS(PI*X)*SIN(PI*Y))**2 +
3     S     (PI*SIN(PI*X)*COS(PI*Y))**2)**&A
3      RETURN
3      END
3      FUNCTION TRUE(X,Y)
3      COMMON /CONCOM/ PI
3      TRUE = SIN(PI*X)*SIN(PI*Y)
3      RETURN
3      END
3      FUNCTION CDXU(X,Y)
3      COMMON /CONCOM/ PI
3      CDXU = (&A)*W(X,Y)**(1.-1./(&A))*PI*PI*SIN(2.*PI*X)*
3     S        COS(2.*PI*Y)
3      RETURN
3      END
3      FUNCTION CDYU(X,Y)
3      COMMON /CONCOM/ PI
3      CDYU = CDXU(Y,X)
3      RETURN
3      END
3      FUNCTION F(X,Y)
3      COMMON /CONCOM/ PI
3      PI2 = PI * PI
3      SINPIX = SIN(PI*X)
3      SINPIY = SIN(PI*Y)
```

```
3     COSPIX = CO(PI*X)
3     COSPIY = CO(PI*Y)
3     TU = SINPIX*SINPIY
3     TUX = PI*CO[illegible]*SINPIY
3     TUXX = -PI**2*TU
3     TUY = PI*SINPIX*COSPIY
3     TUYY = -PI**2*TU
3     F = U(X,Y)*(TUXX + TUYY) + CDXU(X,Y)*TUX + CDYU(X,Y)*TUY
3     RETURN
3     END
```

```
'EOR
************
* MACRO  20 *
************
*         2000030002000
1         TWO DIMENSIONS
1         U$XX + U.YY - EXP(TRUE(X,Y))U$ = F(X,Y)
2         DIRICHLET
2         X=0.01 , U=TRUE(X,Y)
2         X=0.51 , U=TRUE(X,Y)
2         Y=0.00 , U=TRUE(X,Y)
2         Y=0.75 , U=TRUE(X,Y)
3     FUNCTION TRUE(X,Y)
3     TRUE = 10.*PHI(X)*PHI(Y) + (&A)
3     RETURN
3     END
3     FUNCTION F(X,Y)
3     U = 10.*PHI(X)*PHI(Y) + (&A)
3     W = EXP(U)
3     UXX = 10.*DDPHI(X)*PHI(Y)
3     UYY = 10.*PHI(X)*DDPHI(Y)
3     F = UXX + UYY - W*U
3     RETURN
3     END
3     FUNCTION PHI(Z)
3     PHI = (Z-1.)*Z*EXP(-100.*(Z-.5)**2)
3     RETURN
3     END
3     FUNCTION DDPHI(Z)
3     DH = -200.*(Z-.5)
3     DG = 2.*Z-1.
3     H = (Z-.5)*DH/2.
3     G = Z*(Z-1.)
3     DDPHI = (-200.*G + 2.*DH*DG + DH*DH*G + 2.)*EXP(H)
3     RETURN
3     END
```

```
'EOR
************
* MACRO  21 *
************
```

```
'EOR
************
* MACRO  22 *
************
```

```
'EOR
************
* MACRO  23 *
************
*         2003020000300
1         TWO DIMENSIONS
1         U$C(X,Y)UXX$ + U$C(X,Y)UYY$ + DXU$C(X,Y)UX$ +
1.        DYU$C(X,Y)UY$ = F(X,Y)
2         X=0. , U=0.
2         X=1. , U=0.
2         Y=0. , U =TRUE(X,Y)
2         Y=1. , U =TRUE(X,Y)
3     FUNCTION [illegible]
3     CO[illegible]
3     PHI; PI/3.141[illegible]
3     TRUE = CO[illegible]
3     RETURN
3     END
```

```
      FUNCTION U1(X,Y)
      COMMON /CONCON/ PI
      UX = -PI*SIN(PI*X)*(P(Y)+1.)
      UY = COS(PI*X)*D1P(Y)
      H = SQRT(UX*UX + UY*UY)
      U1 = EXP(H*(&A*(&B)*H))/H
      RETURN
      END
      FUNCTION U2(X,Y)
      COMMON /CONCON/ PI
      UX = -PI*SIN(PI*X)*(P(Y)+1.)
      UY = COS(PI*X)*D1P(Y)
      H = SQRT(UX*UX + UY*UY)
      U2 = EXP(H*(&A*(&B)*H))/H
      RETURN
      END
      FUNCTION DYU2(X,Y)
      COMMON /CONCON/ PI
      UX = -PI*SIN(PI*X)*(P(Y)+1.)
      UY = COS(PI*X)*D1P(Y)
      H = SQRT(UX*UX + UY*UY)
      U2Y = -PI*PI*COS(PI*X)*(P(Y)+1.)
      UXY = -PI*SIN(PI*X)*D1P(Y)
      HY = (UX*UXY + UY*U2Y)/H
      D1U2 = -EXP(H*(&A*(&B)*H))*
     $       (U2Y*(&A*(&B)*H)**2+&A*(&B)*HY)/H
     $       +EXP(H*(&A*(&B)*H))
      RETURN
      END
      FUNCTION D2U2(X,Y)
      COMMON /CONCON/ PI
      UX = -PI*SIN(PI*X)*(P(Y)+1.)
      UY = COS(PI*X)*D1P(Y)
      H = SQRT(UX*UX + UY*UY)
      U2Y = -PI*PI*COS(PI*X)*D1P(Y)
      UYY = -PI*SIN(PI*X)*D2P(Y)
      HY = (UX*U2Y + UY*UYY)/H
      D2U2 = -EXP(H*(&A*(&B)*H))*
     $       (U2Y*(&A*(&B)*H)**2+&A*(&B)*HY)/H
     $       +EXP(H*(&A*(&B)*H))
      RETURN
      END
      FUNCTION D1U2(X,Y)
      COMMON /CONCON/ PI
      UX = -PI*SIN(PI*X)*(P(Y)+1.)
      UY = COS(PI*X)*D1P(Y)
      H = SQRT(UX*UX + UY*UY)
      U2Y = -PI*PI*COS(PI*X)*D1P(Y)
      UYY = -PI*SIN(PI*X)*D2P(Y)
      HY = (UX*U2Y + UY*UYY)/H
      D1U2 = -EXP(H*(&A*(&B)*H))*
     $       (U2Y*(&A*(&B)*H)**2+&A*(&B)*HY)/H
     $       +EXP(H*(&A*(&B)*H))
      RETURN
      END
      FUNCTION D2U1(X,Y)
      COMMON /CONCON/ PI
      UX = -PI*SIN(PI*X)*(P(Y)+1.)
      UY = COS(PI*X)*D1P(Y)
      H = SQRT(UX*UX + UY*UY)
      U1Y = -PI*PI*COS(PI*X)*D1P(Y)
      UYY = -PI*SIN(PI*X)*D2P(Y)
      HY = (UX*U1Y + UY*UYY)/H
      D2U1 = -EXP(H*(&A*(&B)*H))*
     $       (U1Y*(&A*(&B)*H)**2+&A*(&B)*HY)/H
     $       +EXP(H*(&A*(&B)*H))
      RETURN
      END
```

```
3      END
3      FUNCTION DXW3(X,Y)
3      COMMON /CONCOM/ PI
3      UX = -PI*SIN(PI*X)*(P(Y)+1.)
3      UY = COS(PI*X)*D1P(Y)
3      H = SQRT(UX*UX + UY*UY)
3      UXX = -PI*PI*COS(PI*X)*(P(Y)+1.)
3      UXY = -PI*SIN(PI*X)*D1P(Y)
3      HX = (UX*UXX+UY*UXY)/H
3      DXW3 = (&A)*(&B)*SECH((&B)*H)**2*HX/H
3     $       -(&A)*TANH((&B)*H)*HX/H**2
3      RETURN
3      END
3      FUNCTION DYW3(X,Y)
3      COMMON /CONCOM/ PI
3      UX = -PI*SIN(PI*X)*(P(Y)+1.)
3      UY = COS(PI*X)*D1P(Y)
3      H = SQRT(UX*UX + UY*UY)
3      UYY = COS(PI*X)*D2P(Y)
3      UXY = -PI*SIN(PI*X)*D1P(Y)
3      HY = (UX*UXY+UY*UYY)/H
3     $        *EXP(H/(2A+(&B)*H))
3      DYW3 = (&A)*(&B)*SECH((&B)*H)**2*HY/H
3     $       -(&A)*TANH((&B)*H)*HY/H**2
3      RETURN
3        D
3      FUNCTION F(X,Y)
3      COMMON /CONCOM/ PI
3      UX = -PI*SIN(PI*X)*(P(Y)+1.)
3      UXX = -PI*PI*COS(PI*X)*(P(Y)+1.)
3      UY  = COS(PI*X)*D1P(Y)
3      UYY = COS(PI*X)*D2P(Y)
3      F = U&C(X,Y)*(UXX+UYY)+DXW&C(X,Y)*UX+DYW&C(X,Y)*UY
3      RETURN
3      END
3      FUNCTION P(X)
3      DATA A, B, C /1.0, 0.0, &D/
3      X1 = .5 - C
3      X2 = .5 + C
3      IF (X .LT. X1) GO TO 1
3      IF (X .GT. X2) GO TO 2
3      DPHI = B - A
3      DX = X2 - X1
3      P = A + DPHI*(X-X1)**3/(DX**3)-3.*DPHI*(X-X1)**3*(X-X2)
3     $    /DX**4 + 6.*DPHI*(X-X1)**3*(X-X2)**2/DX**5
3      RETURN
3    1 P = A
3      RETURN
3    2 P = B
3      RETURN
3      END
3      FUNCTION D1P(X)
3      DATA A, B, C /1.0, 0.0, &D/
3      X1 = .5 - C
3      X2 = .5 + C
3      IF (X .LT. X1) GO TO 1
3      IF (X .GT. X2) GO TO 1
3      DPHI = B - A
3      DX = X2 - X1
3      D1P =  3.*DPHI*(X-X1)**2/(DX**3)-9.*DPHI*(X-X1)**2*(X-X2)
3     $       /DX**4 +18.*DPHI*(X-X1)**2*(X-X2)**2/DX**5
3     $       -3.*DPHI*(X-X1)**3/DX**4
3     $       +12.*DPHI*(X-X1)**3*(X-X2)/DX**5
3      RETURN
3    1 D1P = 0.
3      RETURN
3      END
3      FUNCTION D2P(X)
3      DATA A, B, C /1.0, 0.0, &D/
3      X1 = .5 - C
3      X2 = .5 + C
3      IF (X .LT. X1) GO TO 1
3      IF (X .GT. X2) GO TO 1
3      DPHI = B - A
3      DX = X2 - X1
3      C3 = DPHI/DX**3
```

```
3      C4 = -3.*DPHI/DX**4
3      C5 = 6.*DPHI/DX**5
3      D2P = 6.*C3*(X-X1)+6.*C4*(X-X1)*(X-X2)+
3     $       6.*C4*(X-X1)**2+6.*C5*(X-X1)*(X-X2)**2+
3     $       12.*C5*(X-X1)**2*(X-X2)
3     $       +       2.*C5*(X-X1)**3
3      RETURN
3    1 D2P = 0.
3      RETURN
3      END
```

```
'EOR
*************
* MACRO  24 *
*************
*          2000200000022
1          TWO DIMENSIONS
1          UXX$ + UYY$ + W(X,Y)UX$ = F(X,Y)
2          MIXED $ HOMOGENEOUS
2          X=0.1 , MIXED = (&B)U + (1.)UX + (1.)UY = 0.
2          X=1.0 , MIXED = (&B)U + (1.)UX + (1.)UY = 0.
2          Y=0.1 , MIXED = (&B)U + (1.)UX + (1.)UY = 0.
2          Y=1.0 , MIXED = (&B)U + (1.)UX + (1.)UY = 0.
3      FUNCTION TRUE(X,Y)
3C
3C     ********************************************************
3C     *                                                      *
3C     *                  MACRO 24 PARAMETERS                 *
3C     *                                                      *
3C     ********************************************************
3C     *                                                      *
3C     *              A   I    B   I    C    I  D            *
3C     *           -------I--------I---------I-----           *
3C     *             0.25  I   100  I  -0.10  I  1            *
3C     *                   I        I        I                 *
3C     *             0.25  I  1000  I  -0.10  I  2            *
3C     *                   I        I        I                 *
3C     *             0.50  I     1  I  -0.01  I  3            *
3C     *                   I        I        I                 *
3C     *             0.50  I    10  I  -0.10  I  4            *
3C     *                   I        I        I                 *
3C     *             1.00  I     1  I  -0.10  I  5            *
3C     *                   I        I        I                 *
3C     *             1.00  I    10  I  -0.10  I  6            *
3C     *                   I        I        I                 *
3C     *             1.00  I   100  I  -1.00  I  7            *
3C     *                   I        I        I                 *
3C     *             1.00  I  1000  I  -1.00  I  8            *
3C     *                                                      *
3C     ********************************************************
3C
3      REAL DERVSL(6), GRID(20), TABLE(20,20),
3     $     T1B1(100), T1B2(100), T1B3(100), T1B4(100),
3     $     T2B1(100), T2B2(100), T2B3(100), T2B4(100),
3     $     T3B1(100), T3B2(100), T3B3(100), T3B4(100),
3     $     T4B1(100), T4B2(100), T4B3(100), T4B4(100),
3     $     T5B1(100), T5B2(100), T5B3(100), T5B4(100),
3     $     T6B1(100), T6B2(100), T6B3(100), T6B4(100),
3     $     T7B1(100), T7B2(100), T7B3(100), T7B4(100),
3     $     T8B1(100), T8B2(100), T8B3(100), T8B4(100)
3      EQUIVALENCE (TABLE(1, 1) , T&DB1(1)),
3     $            (TABLE(1, 6) , T&DB2(1)),
3     $            (TABLE(1,11) , T&DB3(1)),
3     $            (TABLE(1,16) , T&DB4(1))
3      DATA NGRID, NGRDD/20, 20/
3      DATA  GRID/0.1000000, 0.1473684, 0.1947368, 0.2421053,
3     $0.2894737, 0.3368421, 0.3842105, 0.4315789, 0.4789474,
3     $0.5263158, 0.5736842, 0.6210526, 0.6684211, 0.7157895,
3     $0.7631579, 0.8105263, 0.8578948, 0.9052632, 0.9526316,
3     $1.0000000/
3C
3C     APPROXIMATE SOLUTION OF PROBLEM USING
3C     P3-C1 COLLOCATION (8 X 8 GRID)
3C
3      DATA T1B1/ 5.947140,-1.985312,-1.841585, -.643261, -.367066,
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3     $ -.000745,  .000224, -.006217, -.024134, -.002506/
3C
3C     INTERPOLATE NUMERICAL SOLUTION BY QUADRATICS
3C
3      CALL QUADRD(X,Y,TABLE,GRID,GRID,NGRID,NGRID,NGRDD,NGRDD,DERUSL)
3C
3      TRUE = DERUSL(6)
3C
3      RETURN
3      END
3      FUNCTION W(X,Y)
3      DATA PI/3.141592656/
3      T = &A*PI*Y
3      W = 3.*T*COS(T*X)/SIN(T*X)
3      RETURN
3      END
3      FUNCTION F(X,Y)
3      DATA PI/3.141592656/
3      T = &A*PI*Y
3      F = &C*T*COS(T*X)/SIN(T*X)**3
3      RETURN
3      END
```

```
'EOR
**************
* MACRO  25 *
**************
*          2000200002002
1          TWO DIMENSIONS
1          (-X**&A)UXXS - (Y**&A)UYYS - (&A*X**(&A-1.))UXS -
1.         (&A*Y**(&A-1.))UYS + ((X*Y)**&A)US = F(X,Y)
2          DIRICHLET S HOMOGENEOUS
2          X=0. , U=0.
2          X=1. , U=0.
2          Y=0. , U=0.
2          Y=1. , U=0.
```

```
3      FUNCTION TRUE(X,Y)
3      TR.. = 3.[illegible]*EXP(Y)*(X-X*X)*(Y-Y*Y)
3      RETURN
3      END
3      FUNCTION F(X,Y)
3      EXPX = EXP(X)
3      EXPY = EXP(Y)
3      F.EY3 = 3.*EXPX*EXPY
3      YMYY = Y - Y**2
3      XMXX = X - X**2
3      TU = EXEY3*(1. - X -X*X)*YMYY
3      TUX = EXEY3*(1. - X -X*X)*YMYY
3      TUXX = EXEY3*(-3*X- X*X)*YMYY
3      TUY = EXEY3*(1. - Y - Y*Y)*XMXX
3      TUYY = EXEY3*(-3*Y-Y*Y)*XMXX
3      F = -X**&A *TUXX - Y**&A * TUYY - &A * X**(&A-1.)*TUX -
3     $      &A * Y**(&A-1.) * TUY + (X*Y)**&A *TU
3      RETURN
3      END
-----------------------------------------------------------------------
*EOR
************
* MACRO  26 *
************
*          2001200102002
1          TWO DIMENSIONS
1          UXXS + UYYS + A(X)UXS = F(X)
2          DIRICHLET & HOMOGENEOUS
2          X=0. , U=0.
2          X=&A , U=0.
2          Y=0. , U=0.
2          Y=&A , U=0.
3      FUNCTION TRUE(X,Y)
3C
3C     ************************************************************
3C     *                                                          *
3C     *                  MACRO 26 PARAMETERS                     *
3C     *                                                          *
3C     ************************************************************
3C     *                                                          *
3C     *                        A  I  B                           *
3C     *                       ------I-----                       *
3C     *                          1  I  1                         *
3C     *                             I                            *
3C     *                          5  I  2                         *
3C     *                             I                            *
3C     *                         10  I  3                         *
3C     *                                                          *
3C     ************************************************************
3C
3      REAL TRUCL(6), TABLE(20,20), GRID1(20),
3     $     GRID2(20), GRID3(20),
3     $     T1B1(100), T1B2(100), T1B3(100), T1B4(100),
3     $     T2B1(100), T2B2(100), T2B3(100), T2B4(100),
3     $     T3B1(100), T3B2(100), T3B3(100), T3B4(100)
3      EQUIVALENCE (TABLE(1, 1) , T&B1(1)),
3     $            (TABLE(1, 6) , T&B2(1)),
3     $            (TABLE(1,11) , T&B3(1)),
3     $            (TABLE(1,16) , T&B4(1))
3      DATA NGRID, NGRID/20, 20/
3      DATA GRID1/0.0000000, 0.0526316, 0.1052632, 0.1578947,
3     $0.2105263, 0.2631579, 0.3157895, 0.3684211, 0.4210526,
3     $0.4736842, 0.5263158, 0.5789474, 0.6315789, 0.6842105,
3     $0.7368421, 0.7894737, 0.8421053, 0.8947368, 0.9473684,
3     $1.0000000/
3      DATA GRID2/0.0000000, 0.2631579, 0.5263158, 0.7894737,
3     $1.0526316, 1.3157895, 1.5789474, 1.8421053, 2.1052632,
3     $2.3684211, 2.6315789, 2.8947368, 3.1578947, 3.4210526,
3     $3.6842105, 3.9473684, 4.2105263, 4.4736842, 4.7368421,
3     $5.0000000/
3      DATA GRID3/0.0000000, 0.5263158, 1.0526316, 1.5789474,
3     $2.1052632, 2.6315789, 3.1578947, 3.6842105, 4.2105263,
3     $4.7368421, 5.2631579, 5.7894737, 6.3157895, 6.8421053,
3     $7.3684211, 7.8947368, 8.4210526, 8.9473684, 9.4736842,
3     $10.000000/
3C
```

```
C      APPROXIMATE SOLUTION OF [illegible] USING
C      [illegible]
3C
3      DATA T1B1/ [illegible], [illegible], [illegible], .000000, .000000,
3     $ [illegible], .000000, [illegible], .000000, .000000, .000000,
3     $ [illegible], .000000, .000000, .000000, .000000, .000000,
3     $ [illegible], .000000, .000000, .000000, .042334, .083348,
3     $ [illegible], .159413, .174636, .188130, .200377, .213527,
3     $ .218113, .200288, .183343, .156612, .102537, .142198,
3     $ .118909, .094800, .062345, .025037, .000000, .000000,
3     $ .077317, .152142, .215033, .277020, .324418, .358727,
3     $ .381349, .380356, .360092, .376143, .335702, .328112,
3     $ .204592, .258261, .212345, .187776, .117358, .062802,
3     $ .000000, .000000, .100913, .203464, .301010, .380454,
3     $ .444612, .491633, .521213, .531100, .531294, .514625,
3     $ .458031, .407462, .400612, .347072, .227959, .223801,
3     $ .154680, .080524, .000000, .000000, .129326, .254044,
3     $ .376910, .463675, .541872, .609148, .635105, .650622,
3     $ .610038, .626105, .590039, .542255, .484873, .418680,
3     $ .345776, .287031, .163171, .034230, .000000/
3C
3      DATA T1B2/ .000000, .142361, .289094, .418904, .529491,
3     $ .618776, .684134, .725081, .742592, .727993, .713799,
3     $ .672801, .517355, .453375, .473871, .380023, .299795,
3     $ .204368, .104543, .000000, .000000, .162509, .317759,
3     $ .453163, .575081, .677772, .742306, .784040, .813019,
3     $ .837676, .730753, .635204, .674914, .558943, .515620,
3     $ .423137, .324204, .220113, .111316, .000000, .000000,
3     $ .172777, .337338, .487852, .612034, .720570, .796569,
3     $ .814084, .854032, .853093, .829142, .780285, .714760,
3     $ .626516, .545414, .443023, .341541, .231254, .117098,
3     $ .000000, .000000, .178440, .350867, .510655, .640407,
3     $ .749331, .827217, .876422, .897075, .880731, .860421,
3     $ .803412, .741012, .655331, .564512, .461923, .352565,
3     $ .238331, .120447, .000000, .000000, .162740, .357318,
3     $ .515930, .652177, .762075, .843038, .892457, .913425,
3     $ .903373, .875887, .823785, .753977, .669636, .573930,
3     $ .453371, .353024, .241313, .122035, .000000/
3C
3      DATA T1B3/ .000000, .182740, .357318, .515980, .652177,
3     $ .762075, .842338, .892457, .913425, .905273, .875887,
3     $ .823785, .753377, .669636, .573930, .463371, .358024,
3     $ .241313, .122035, .000000, .000000, .179440, .350867,
3     $ .500005, .640407, .749331, .827217, .876422, .897075,
3     $ .880731, .860421, .803402, .741012, .650381, .564512,
3     $ .461923, .352565, .238331, .120447, .000000, .000000,
3     $ .172777, .337338, .487852, .612034, .720570, .796569,
3     $ .844084, .854032, .853093, .829142, .780285, .714760,
3     $ .626516, .545414, .443023, .341541, .231254, .117098,
3     $ .000000, .000000, .162509, .317759, .453338, .579991,
3     $ .677772, .742306, .784040, .813019, .837676, .780758,
3     $ .730753, .674914, .571043, .518020, .423137, .324204,
3     $ .220113, .111316, .000000, .000000, .143331, .290094,
3     $ .418904, .529491, .618776, .684134, .726031, .742592,
3     $ .727993, .713799, .672801, .547035, .550075, .473971,
3     $ .380023, .299795, .204368, .104543, .000000/
3C
3      DATA T1B4/ .000000, [illegible], .258044, .386340, .463675,
3     $ .541872, .609148, .635105, .650622, .643334, .626105,
3     $ .590039, .542255, .484873, .418680, .345776, .287031,
3     $ .163171, .034230, .000000, .000000, .100918, .203464,
3     $ .301010, .380454, .444612, .491633, .521213, .531100,
3     $ .531294, .514625, .458031, .407462, .400612, .347072,
3     $ .227959, .223801, .154680, .080524, .000000, .000000,
3     $ .077317, .152142, .215033, .277020, .324418, .358727,
3     $ .381349, .380356, .360092, .376143, .335702, .328112,
3     $ .204592, .258261, .212345, .187776, .117358, .062802,
3     $ [illegible], .000000, [illegible], .025038, .102027, .152048,
3     $ [illegible], [illegible], [illegible], .216527, .213513, .206289,
3     $ [illegible], [illegible], [illegible], .162163, .118918, .094900,
3     $ [illegible], [illegible], [illegible], .000000, .000000, .000000,
3     $ [illegible], [illegible], [illegible], .000000, .000000, .000000,
3     $ [illegible], [illegible], [illegible], .000000, .000000, .000000,
3     $ [illegible], [illegible], [illegible], .000000, .000000/
3C
3      DATA T1B5/ [illegible], [illegible], .000000, .000000, .000000,
```

```
3     $  .[illegible],  .[illegible],  .[illegible],  .[illegible],  .000000,  .000000,
3     $  .[illegible],  .[illegible],  .[illegible],  .[illegible],  .000000,  .000000,
3     $  .[illegible],  .[illegible],  .[illegible],  .000000,  .102525,  .191764,
3     $  .[illegible],  .[illegible],  .[illegible],  .237702,  .275360,  .244927,
3     $  .[illegible],  .[illegible],  .[illegible],  .113032,  .094408,  .073060,
3     $  .[illegible],  .[illegible],  .[illegible],  .012443,  .000000,  .000000,
3     $  .[illegible],  .[illegible],  .[illegible],  .515726,  .541814,  .531769,
3     $  .[illegible],  .[illegible],  .[illegible],  .327343,  .270964,  .219922,
3     $  .[illegible],  .135[illegible],  .[illegible],  .071197,  .045224,  .021883,
3     $  .[illegible],  .000000,  .230032,  .[illegible]33653,  .593558,  .683554,
3     $  .722341,  .714[illegible],  .671183,  .605207,  .528363,  .449927,
3     $  .373393,  .3[illegible],  .241530,  .185791,  .135261,  .097908,
3     $  .[illegible],  .029424,  .000000,  .000000,  .270292,  .510525,
3     $  .[illegible],  .811300,  .892305,  .857239,  .809007,  .732986,
3     $  .643[illegible],  .549091,  .457233,  .372718,  .298468,  .229286,
3     $  .170743,  .119718,  .075076,  .035566,  .000000/
3C
3        DATA T2D2/  .000000,  .293704,  .559987,  .774418,  .906644,
3     $  .993[illegible]5,  .955795,  .915036,  .832302,  .732935,  .627401,
3     $  .5[illegible]21,  .427567,  .340413,  .263309,  .195928,  .137123,
3     $  .[illegible]5726,  .[illegible]0423,  .000000,  .000000,  .321059,  .608088,
3     $  .832154,  .976754,  1.045303,  1.048674,  .994722,  .907380,
3     $  .[illegible]01115,  .687293,  .574760,  .466354,  .374373,  .289632,
3     $  .215416,  .150580,  .093351,  .044183,  .000000,  .000000,
3     $  .339330,  .636753,  .872549,  1.025008,  1.100876,  1.104048,
3     $  1.051503,  .961181,  .850211,  .730602,  .611797,  .500625,
      $  .399131,  .303345,  .229947,  .160405,  .099954,  .046921,
      $  .000000,  .000000,  .345240,  .654738,  .837943,  1.057089,
3     $  1.135704,  1.140559,  1.087806,  .995738,  .831856,  .758614,
3     $  .635824,  .520632,  .415256,  .321371,  .238928,  .166812,
3     $  .105[illegible]3,  .048706,  .000000,  .000000,  .349799,  .663544,
3     $  .910393,  1.072339,  1.152313,  1.152518,  1.105685,  1.012777,
3     $  .897463,  .772463,  .647716,  .530542,  .423247,  .327581,
3     $  .243531,  .163390,  .105809,  .049592,  .000000/
3C
3        DATA T2D3/  .000000,  .349799,  .663544,  .910393,  1.072339,
3     $  1.152313,  1.152518,  1.105685,  1.012777,  .897493,  .772463,
3     $  .647716,  .530542,  .423247,  .327581,  .243531,  .169990,
3     $  .105309,  .049592,  .000000,  .000000,  .345240,  .654738,
3     $  .837943,  1.057089,  1.135704,  1.140559,  1.087806,  .995738,
3     $  .831856,  .758614,  .635824,  .520632,  .415256,  .321371,
3     $  .238928,  .166812,  .103268,  .048706,  .000000,  .000000,
3     $  .339330,  .636753,  .872549,  1.025008,  1.100876,  1.104048,
3     $  1.051503,  .961181,  .850211,  .730602,  .611797,  .500625,
3     $  .399131,  .302345,  .229947,  .160405,  .099954,  .046921,
3     $  .000000,  .000000,  .321059,  .608088,  .832154,  .976754,
3     $  1.045303,  1.048674,  .994722,  .907380,  .801115,  .687293,
3     $  .574760,  .466354,  .374373,  .289632,  .215416,  .150580,
3     $  .093351,  .044183,  .000000,  .000000,  .299704,  .566987,
3     $  .774418,  .906644,  .993026,  .955795,  .915086,  .832302,
3     $  .732935,  .627401,  .523721,  .427567,  .340413,  .263309,
3     $  .195928,  .137123,  .085726,  .040429,  .000000/
3C
3        DATA T2D4/  .000000,  .270292,  .510525,  .693443,  .811300,
3     $  .[illegible],  .857223,  .809007,  .732986,  .643302,  .549094,
3     $  .457233,  .372718,  .298468,  .229286,  .170743,  .119718,
3     $  .075076,  .035566,  .000000,  .000000,  .230032,  .433653,
3     $  .[illegible],  .[illegible]31554,  .722341,  .714353,  .671183,  .605207,
3     $  .528363,  .4[illegible]927,  .373398,  .3[illegible],  .241530,  .185791,
3     $  .1[illegible]1,  .097903,  .061535,  .029424,  .000000,  .000000,
3     $  .175[illegible],  .331016,  .[illegible]7043,  .515726,  .541314,  .531769,
3     $  .[illegible]73,  .[illegible]433,  .339486,  .327343,  .270964,  .219922,
3     $  .170[illegible]3,  .135[illegible],  .[illegible],  .071197,  .045224,  .021883,
      $  .[illegible],  .000000,  .102525,  .191764,  .257172,  .294088,
3     $  .[illegible],  .237702,  .275360,  .244927,  .211656,  .178373,
3     $  .[illegible],  .113032,  .094408,  .073060,  .054711,  .038851,
      $  .[illegible],  .012443,  .000000,  .000000,  .000000,  .000000,
      $  .[illegible],  .000000,  .000000,  .000000,  .000000,  .000000,
      $  .[illegible],  .000000,  .000000,  .000000,  .000000,  .000000,
      $  .[illegible],  .000000,  .000000,  .000000,  .000000/

         [illegible]  .000000,  .000000,  .000000,  .000000,  .000000,
      $  .[illegible],  .000000,  .000000,  .000000,  .000000,  .000000,
      $  .[illegible],  .000000,  .000000,  .000000,  .000000,  .000000,
      $  .[illegible],  .000000,  .000000,  .000000,  .136762,  .242995,
      $  .[illegible],  .293704,  .263364,  .243177,  .204939,  .163207,
```

```
3     $  .127521,  .093047,  .074440,  .055939,  .041610,  .030429,
3     $  .021073,  .014742,  .009126,  .004333,  .000000,  .000000,
3     $  .225332,  .494804,  .507648,  .532131,  .502014,  .441152,
3     $  .368813,  .233623,  .233567,  .180324,  .137691,  .103813,
3     $  .077267,  .056478,  .040114,  .027141,  .016590,  .007756,
3     $  .000000,  .000000,  .285009,  .515325,  .653481,  .693679,
3     $  .693031,  .588513,  .497784,  .403800,  .320122,  .240260,
3     $  .199431,  .143963,  .107283,  .078416,  .055604,  .037472,
3     $  .022720,  .010482,  .000000,  .000000,  .327257,  .594199,
3     $  .758585,  .812100,  .783379,  .702581,  .537871,  .488376,
3     $  .389384,  .304079,  .233482,  .176946,  .132044,  .096533,
3     $  .068385,  .045970,  .027761,  .012719,  .000000/
3C
3      DATA T3B2/  .000000,  .356408,  .649089,  .832755,  .897181,
3     $  .871521,  .786942,  .673823,  .553568,  .443463,  .347646,
3     $  .267723,  .203343,  .151932,  .111112,  .078670,  .052794,
3     $  .031790,  .014504,  .000000,  .000000,  .376737,  .687549,
3     $  .885147,  .957941,  .935238,  .848835,  .730092,  .602415,
3     $  .484381,  .380883,  .294030,  .222721,  .167338,  .122430,
3     $  .088661,  .058095,  .034918,  .015088,  .000000,  .000000,
3     $  .380468,  .713611,  .920844,  .988654,  .979355,  .891822,
3     $  .769750,  .637142,  .513591,  .404848,  .313095,  .238555,
3     $  .178587,  .130709,  .092514,  .061978,  .037209,  .016902,
3     $  .000000,  .000000,  .338828,  .729526,  .942756,  1.025437,
3     $ 1.006835,  .918904,  .794843,  .659279,  .532496,  .420307,
3     $  .325452,  .248203,  .185921,  .136116,  .088339,  .064516,
3     $  .038706,  .017565,  .000000,  .000000,  .402888,  .737259,
3     $  .953417,  1.038004,  1.020257,  .932162,  .807155,  .670167,
3     $  .541764,  .427941,  .331563,  .252981,  .189557,  .138799,
3     $  .093238,  .065777,  .039450,  .017894,  .000000/
3C
3      DATA T3B3/  .000000,  .402888,  .737259,  .953417,  1.038004,
3     $ 1.020257,  .932162,  .807155,  .670167,  .541764,  .427941,
3     $  .331563,  .252981,  .189557,  .138799,  .093238,  .065777,
3     $  .039450,  .017894,  .000000,  .000000,  .338828,  .729526,
3     $  .942756,  1.025437,  1.006835,  .918904,  .794843,  .659279,
3     $  .532496,  .420307,  .325452,  .248203,  .185921,  .136116,
3     $  .096339,  .064516,  .038706,  .017565,  .000000,  .000000,
3     $  .380468,  .713611,  .920844,  .988654,  .979355,  .891822,
3     $  .769750,  .637142,  .513591,  .404848,  .313095,  .238555,
3     $  .178587,  .130709,  .092514,  .061978,  .037209,  .016902,
3     $  .000000,  .000000,  .376737,  .687549,  .885147,  .957941,
3     $  .935238,  .848835,  .730092,  .602415,  .484381,  .380883,
3     $  .294030,  .222721,  .167338,  .122430,  .088661,  .058095,
3     $  .034918,  .015088,  .000000,  .000000,  .356408,  .649089,
3     $  .832755,  .897181,  .871521,  .786942,  .673823,  .553568,
3     $  .443463,  .347646,  .267723,  .203343,  .151932,  .111112,
3     $  .078670,  .052794,  .031790,  .014504,  .000000/
3C
3      DATA T3B4/  .000000,  .327257,  .594199,  .758585,  .812100,
3     $  .783379,  .702581,  .537871,  .488376,  .389384,  .304079,
3     $  .233482,  .176946,  .132044,  .096533,  .068385,  .045970,
3     $  .027761,  .012719,  .000000,  .000000,  .285009,  .515325,
3     $  .653481,  .693679,  .693031,  .588513,  .497784,  .403800,
3     $  .320122,  .240260,  .199431,  .143963,  .107283,  .078416,
3     $  .055604,  .037472,  .022720,  .010482,  .000000,  .000000,
3     $  .225332,  .494804,  .507648,  .532131,  .502014,  .441152,
3     $  .368813,  .233623,  .233567,  .180324,  .137691,  .103813,
3     $  .077267,  .056478,  .040114,  .027141,  .016590,  .007756,
3     $  .000000,  .000000,  .136763,  .242835,  .300166,  .309204,
3     $  .288664,  .243177,  .204939,  .163207,  .127521,  .098047,
3     $  .074440,  .055939,  .041610,  .030429,  .021073,  .014742,
3     $  .009126,  .004333,  .000000,  .000000,  .000000,  .000000,
3     $  .000000,  .000000,  .000000,  .000000,  .000000,  .000000,
3     $  .000000,  .000000,  .000000,  .000000,  .000000,  .000000,
3     $  .000000,  .000000,  .000000,  .000000,  .000000/
3C
3C     INTERPOLATE NUMERICAL SOLUTION BY QUADRATICS
3C
3      CALL QUADRD(X,Y,TABLE,GRID&B,GRID&B,NGRID,NGRID,NGRDD,NGRDD,
3     $            DERUSL)
3C
3      TRUE = DERUSL(6)
3C
3      RETURN
3      END
```

```
3       FUNCTION A(X)
3       A = 6.*(1.+X*X)**2/(&0+X*X)**3
3       RETURN
3       END
3       FUNCTION F(X)
3       F = -60.*(...) (&A+X*X)**3
3       RETURN
3       END
-------------------------------------------------------------------------
'EOR
**************
* MACRO  27 *
**************
-------------------------------------------------------------------------
'EOR
**************
* MACRO  28 *
**************
*          2000002002002
1          TWO DIMENSIONS $ SELF-ADJOINT
1          U(X,Y)UXXS + U(X,Y)UYYS = 1.0
2          DIRICHLET $ HOMOGENEOUS
2          X=-1. , U=0.
2          X= 1. , U=0.
2          Y=-1. , U=0.
2          Y= 1. , U=0.
3       FUNCTION TRUE(X,Y)
3C
3C      ***********************************************************
3C      *                                                         *
3C      *                  MACRO 28 PARAMETERS                    *
3C      *                                                         *
3C      ***********************************************************
3C      *                                                         *
3C      *                          A   I  B                       *
3C      *                   --------I-----                        *
3C      *                          1  I  1                        *
3C      *                             I                           *
3C      *                         10  I  2                        *
3C      *                             I                           *
3C      *                       1000  I  3                        *
3C      *                                                         *
3C      ***********************************************************
3C
3       REAL DERVSL(6), GRID(20), TABLE(20,20),
3      $      T1B1(100), T1B2(100), T1B3(100), T1B4(100),
3      $      T2B1(100), T2B2(100), T2B3(100), T2B4(100),
3      $      T3B1(100), T3B2(100), T3B3(100), T3B4(100)
3       EQUIVALENCE (TABLE(1, 1) , T&B1(1)),
3      $              (TABLE(1, 6) , T&B2(1)),
3      $              (TABLE(1,11) , T&B3(1)),
3      $              (TABLE(1,16) , T&B4(1))
3       DATA NGRID, NGRDD, GRID /20, 20, -1.000000, -.8947368,
3      $-.7894737, -.6842105, -.5789474, -.4736842, -.3684211,
3      $-.2631579, -.1578947, -.0526316, 0.0526316, 0.1578947,
3      $0.2631579, 0.3684211, 0.4736842, 0.5789474, 0.6842105,
3      $0.7894737, 0.8947368, 1.0000000/
3C
3C      APPROXIMATE SOLUTION OF PROBLEM USING
3C      DYAKANOV-CG4 (ITMAX=11, DEMAND=6, 21 X 21 GRID)
3C
3       DATA T1B1/  .000000, -.000125, -.000145, -.000140, -.000133,
3      $ -.000125, -.000113, -.000113, -.000109, -.000106, -.000106,
3      $ -.000109, -.000113, -.000119, -.000125, -.000133, -.000140,
3      $ -.000145, -.000125,  .000000, -.000125, -.013931, -.032143,
3      $ -.041931, -.049433, -.055241, -.0[illegible]547, -.032527, -.004613,
3      $ -.035537, -.[illegible], -.064913, -.[illegible], -.0[illegible]547, -.055241,
3      $ -.049[illegible], -.[illegible]931, -.032143, -.0[illegible]931, -.000125, -.000145,
3      $ -.0231[illegible], -.[illegible], -.075177, -.[illegible], -.1[illegible], -.100235,
3      $ -.11[illegible], -.11[illegible], -.1[illegible]933, -.[illegible], -.1[illegible]156, -.115263,
3      $ -.100[illegible], -.[illegible], -.[illegible], -.[illegible], -.051504, -.032143,
3      $ -.[illegible], -.[illegible], -.[illegible], -.[illegible], -.1[illegible], -.121984,
3      $ -.1[illegible], -.[illegible], -.[illegible], -.1[illegible]577, -.137557, -.167557,
3      $ -.1[illegible], -.[illegible], -.159130, -.1[illegible], -.121834, -.101338,
3      $ -.075177, -.0[illegible]931, -.000149, -.000133, -.049433, -.085570,
3      $ -.121034, -.1[illegible]7501, -.163023, -.133[illegible], -.194570, -.201792,
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 5 -.[illegible], -.[illegible], -.[illegible], -.[illegible], -.000113,
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      DATA T23/ -.000052, -.050636, -.090696, -.120678, -.140850,
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      $ -.000004, -.000074, -.045960, -.080833, -.109441, -.122589,
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C
      DATA T25/  .000000, -.000125, -.000145, -.000138, -.000129,
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3     $ -.123716, -.118573, -.105295, -.083582, -.065096, -.079162,
3     $ -.074048, -.068520, -.062040, -.053199, -.041601, -.024230,
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3     $ -.106697, -.121752, -.126948, -.121652, -.105295, -.071670,
3     $ -.031624, -.010127, -.008866, -.007917, -.006932, -.006014,
3     $ -.005051, -.003883, -.002798, -.001308,  .001546/
3C
3      DATA T3B3/ -.000031, -.045345, -.079325, -.104105, -.117849,
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3     $ -.002215, -.001160, -.000001, -.000073, -.033541, -.066789,
3     $ -.085432, -.094351, -.095325, -.089536, -.068520, -.038146,
3     $ -.006014, -.006483, -.005931, -.005435, -.004848, -.004214,
3     $ -.003525, -.002770, -.001938, -.001019, -.000001/
3C
3      DATA T3B4/ -.000089, -.035322, -.060756, -.077292, -.085526,
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3     $ -.001639, -.000867, -.000001, -.000114, -.030832, -.052425,
3     $ -.066158, -.072880, -.073105, -.068903, -.053199, -.029621,
3     $ -.003383, -.004283, -.003920, -.003555, -.003175, -.002770,
3     $ -.002330, -.001847, -.001308, -.000693, -.000001, -.000135,
3     $ -.024474, -.040846, -.050847, -.055817, -.056022, -.051332,
3     $ -.041601, -.023489, -.002798, -.003005, -.002735, -.002477,
3     $ -.002215, -.001938, -.001639, -.001308, -.000935, -.000507,
3     $ -.000001, -.000121, -.014964, -.024140, -.028587, -.032159,
3     $ -.032230, -.028968, -.024230, -.013647, -.001308, -.001581,
3     $ -.001430, -.001294, -.001160, -.001019, -.000867, -.000698,
3     $ -.000507, -.000231, -.000001,  .000000, -.000128, -.000157,
3     $ -.000170, -.000179, -.000213, -.000244, -.000278, -.000897,
3     $  .001546,  .000003,  .000001, -.000000, -.000001, -.000001,
3     $ -.000001, -.000001, -.000001, -.000001,  .000000/
3C
3C     INTERPOLATE NUMERICAL SOLUTION BY QUADRATICS
3C
3      CALL QUADRD(X,Y,TABLE,GRID,GRID,NGRID,NGRID,NGRDD,NGRDD,DERVSL)
3C
3      TRUE = DERVSL(S)
3C
3      RETURN
3      END
3      FUNCTION W(X,Y)
3      W = 1.
3      IF (X .LT. 0. .OR. Y .LT. 0.) RETURN
3      W = 0.
3      RETURN
3      END
3      FUNCTION CDXU(X,Y)
3      CDXU = 0.
3      RETURN
3      END
3      FUNCTION CDYU(X,Y)
3      CDYU = 0.
3      RETURN
3      END
```

```
*EOR
**********
* MACRO  23 *
**********
```

```
*          2000200302000
1          TWO DIMENSIONS 6 HOMOGENEOUS
1          U(X) + U(Y) + U(X,Y) = 0.
2          DIRICHLET
2          X=0. , 0≤Y≤1.
2          X=1. , 0≤Y≤1.
2          Y=0. , 0≤X≤1.
2          Y=1. , 0≤X≤1.
3      FUNCTION TRUE(X,Y)
3C
3C     ***********************************************************
3C     *                                                         *
3C     *                  MACRO 23 PARAMETERS                    *
3C     *                                                         *
3C     ***********************************************************
3C     *                                                         *
3C     *                        A  I  B                          *
3C     *                       ----I----                         *
3C     *                        -3 I  1                          *
3C     *                           I                             *
3C     *                        -1 I  2                          *
3C     *                           I                             *
3C     *                         1 I  3                          *
3C     *                           I                             *
3C     *                         3 I  4                          *
3C     *                           I                             *
3C     *                         5 I  5                          *
3C     *                                                         *
3C     ***********************************************************
3C
3      REAL DERVSL(6), GRID(20), TABLE(20,20),
3     $     T1B1(100), T1B2(100), T1B3(100), T1B4(100),
3     $     T2B1(100), T2B2(100), T2B3(100), T2B4(100),
3     $     T3B1(100), T3B2(100), T3B3(100), T3B4(100),
3     $     T4B1(100), T4B2(100), T4B3(100), T4B4(100),
3     $     T5B1(100), T5B2(100), T5B3(100), T5B4(100)
3      EQUIVALENCE (TABLE(1, 1) , T&BB1(1)),
3     $            (TABLE(1, 6) , T&BB2(1)),
3     $            (TABLE(1,11) , T&BB3(1)),
3     $            (TABLE(1,16) , T&BB4(1))
3      DATA NGRID, NGRDD, GRID /20, 20,  0.000000, 0.0526316,
3     $0.1052632, 0.1578947, 0.2105263, 0.2631579, 0.3157895,
3     $0.3684211, 0.4210526, 0.4736842, 0.5263158, 0.5789474,
3     $0.6315789, 0.6842105, 0.7368421, 0.7894737, 0.8421053,
3     $0.8947368, 0.9473684, 1.0000000/
3C
3C     APPROXIMATE SOLUTION OF PROBLEM USING
3C     P3-C1 COLLOCATION (8 X 8 GRID)
3C
3      DATA T1B1/  .000000, -.017544, -.035088, -.052632, -.070175,
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3     $ -.136139, -.172935, -.206238, -.236465, -.263158/
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3      DATA T2B4/  .789474,  .714222,  .642438,  .573566,  .507419,
3     $  .442912,  .382753,  .323829,  .267063,  .212449,  .159779,
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3     $  .526316,  .473684,  .421053,  .368421,  .315789,  .263158,
3     $  .210526,  .157895,  .105263,  .052632,  .000000/
3C
3      DATA T3B1/  .000000,  .052632,  .105263,  .157895,  .210526,
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3     $  .894737, -.157895, -.201543, -.223105, -.241041, -.241532,
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3     $ -.252345, -.195923, -.138593, -.080211, -.019909,  .041528,
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3     $ -.392150, -.338593, -.284712, -.230189, -.175253, -.119777,
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      $ .[illegible], -.[illegible], -.[illegible], -.1[illegible], -.106178, -.095632,
      $ .[illegible], -.[illegible]1421, -.[illegible]7761, -.[illegible], -.025100, -.007716,
      $ .[illegible], .[illegible], .[illegible], -.1[illegible], -.150932, -.150790,
      $ -.1[illegible], -.1[illegible], -.133333, -.131[illegible]14, -.123318, -.114235,
      $ -.[illegible], -.[illegible]3331, -.[illegible]3049, -.070556, -.057574, -.043474,
      $ .[illegible]3313, .011[illegible], .007[illegible], .022527, .052632/
 C
3     DATA T53/ -.157335, -.153077, -.159307, -.152711, -.147098,
3     $ -.1[illegible]311, -.132104, -.123331, -.113553, -.105936, -.093395,
3     $ -.[illegible]2267, -.0[illegible]0591, -.[illegible]3256, -.045046, -.030954, -.015693,
3     $ .001454, .020411, .042105, -.168421, -.165359, -.162771,
3     $ -.159940, -.149331, -.141045, -.133140, -.123867, -.114115,
3     $ -.103379, -.093449, -.082536, -.071224, -.059442, -.047097,
3     $ -.[illegible]34092, -.020063, -.004845, .012134, .031579, -.178947,
3     $ -.17[illegible]331, -.1[illegible]373, -.161370, -.153125, -.143910, -.134603,
3     $ -.1[illegible]3, -.11[illegible]27, -.104432, -.093351, -.083056, -.072057,
3     $ -.[illegible], -.[illegible]59, -.035373, -.024338, -.010537, .004181,
3     $ .[illegible]53, -.1[illegible]4, -.1[illegible]33, -.174334, -.165200, -.155746,
3     $ -.1[illegible]31, -.1[illegible]32, -.125910, -.115234, -.104359, -.094306,
3     $ -.[illegible], -.0[illegible]16, -.062044, -.050875, -.039742, -.028244,
3     $ -.016[illegible]1, -.003311, .010526, -.200000, -.189474, -.178947,
3     $ -.1[illegible]1, -.157895, -.147368, -.136842, -.126316, -.115789,
3     $ -.10[illegible]63, -.09[illegible]37, -.084211, -.073684, -.063158, -.052632,
3     $ -.[illegible]2105, -.031573, -.021053, -.010526, .000000/
3C
3C    INTERPOLATE [illegible]ERICAL SOLUTION BY QUADRATICS
3C
3     CALL QUADPD(X,Y,TABLE,GRID,GRID,NGRID,NGRID,NGRDD,NGRDD,DERVSL)
3C
3     TRUE = DER[illegible]SL(8)
3C
3     RETURN
3     END
3     FUNCTION W(Y)
3     W = 0.
3     IF (Y .EQ. 0.) RETURN
3     W = [illegible]*Y
3     RETURN
3     END
--------------------------------------------------------------------------------
*EOR
**************
* [illegible] 3[illegible] *
**************
*          [illegible]
1          T[illegible] [illegible]SIONS
1          [illegible] + COEF2(X,Y)UYYS + COEF3(X,Y)US = F(X,Y)
2          DIRICHLET
2          [illegible]. , U[illegible]E(X,Y)
2          X=1. , U[illegible]E(X,Y)
2          [illegible]. , U[illegible]E(X,Y)
2          [illegible]1. , U[illegible]E(X,Y)
3     FUNCTION [illegible](X,Y)
3     [illegible] C
3     [illegible]
3     [illegible]1 = [illegible] + [illegible]EXP(-A*Y**4)
3     [RETURN]
3     [END]
3     FUNCTION [illegible]
3     [illegible] C
3     [illegible]2 = 1. + 1.[illegible]2.*X)**3)
3     [RETURN]
3     [END]
3     FUNCTION [illegible]3(X,Y)
3     [illegible] C
3     [illegible] = [illegible] + (Y-.3)*(Y-.7) )
3     [illegible]
3     [END]
3     FUNCTION F(X,Y)
3     [illegible] C
3     [illegible]
3     [illegible] .LE. 0.0)) RETURN
```

```
3      F1 = X + Y**2
3      P1 = (2.*X)**(B-1.)
3      DP1 = 2.*(B-1.)*(2.*X)**(B-2.)
3      DDP1 = 4.*(B-1.)*(B-2.)*(2.*X)**(B-3.)
3      DEN1 = 1. + F1
3      U1 = F1/DEN1
3      UXX1 = -(2.*(1. - F1*DP1/DEN1)*DP1 + F1*DDP1)/DEN1**2
3      UYY1 = 2./DEN1
3      E2 = EXP(-A*Y**4)
3      U2 = (1.+X)*(Y-1.)*E2
3      UXX2 = 0.0
3      UYY2 = (-4.*A*C2*((5.*Y-3.) - 4*A*Y**4*(Y-1.))*Y**2)*(1.+X)
3      C3 = COS(X*Y)
3      S3 = SIN(X*Y)
3      XY3 = X+Y
3      U3 = C*XY3*C3
3      UXX3 = -Y*(2.*C*S3 + Y*U3)
3      UYY3 = -X*(2.*C*S3 + X*U3)
3      COE1 = 2. + (Y-1.)*E2
3      COE2 = 1. + 1./(1.+2.*X*P1)
3      COE3 = C*(X*(X-1.)+(Y-.3)*(Y-.7))
3      F = COE1*(UXX1+UXX2+UXX3) + COE2*(UYY1+UYY2+UYY3) +COE3*(U1+U2+U3)
3      RETURN
3      END
3      FUNCTION TRUE(X,Y)
3      COMMON /CONCOM/ A,B,C
3      TRUE = (X+Y*Y)/(1.+(2.*X)**(B-1.))
3     $      + (Y-1.)*(1.+X)*EXP(-A*Y**4)
3     $      + C*(X+Y)*COS(X*Y)
3      RETURN
3      END
-------------------------------------------------------------------------------
'EOR
**************
* MACRO  31 *
**************
-------------------------------------------------------------------------------
'EOR
**************
* MACRO  32 *
**************
-------------------------------------------------------------------------------
'EOR
**************
* MACRO  33 *
**************
-------------------------------------------------------------------------------
'EOR
**************
* MACRO  34 *
**************
-------------------------------------------------------------------------------
'EOR
**************
* MACRO  35 *
**************
*          20220212200020
1          TWO DIMENSIONS $ CONSTANT COEFFICIENTS $ HOMOGENEOUS
1          POISSON $ LAPLACE
1          UXX3 + UYY3 = 0.
2          MIXED
2          X=-1. , MIXED = (1.+(&A))U + (-(&A))UX = G(X,Y)
2          X= 1. , MIXED = (1.+(&A))U +    (&A)UX = G(X,Y)
2          Y=-1. ,                  U             = TRUE(X,Y)
2          Y= 1. ,                  U             = TRUE(X,Y)
3      FUNCTION TRUE(X,Y)
3      X2 = X*X
3      X1 = X2*X2
3      X4 = X2*X1
3      X8 = X4*X4
3      Y2 = Y*Y
3      Y4 = Y2*Y2
3      Y8 = Y4*Y4
3      U1 = X4 - 6.*X2*Y2 + Y4
3      U2 = X8 - 28.*X6*Y2 + 70.*X4*Y4 - 28.*X2*Y6 + Y8
```

```
3     TRUE = 1.1786 - .1801*U1 + .006*U2
3     RETURN
3     END
3     FUNCTION G(X,Y)
3     U1X = 4.*X**3 - 12.*X*Y**2
3     U2X = 8.*X**7 - 168.*X**5*Y**2 + 280.*X**3*Y**4 -
3    $       56.*X*Y**6
3     UX  = -.1801*U1X + .006*U2X
3     U   = TRUE(X,Y)
3     G = (1.+(&A))*U + SIGN(1.0,X)*(&A)*UX
3     RETURN
3     END
-------------------------------------------------------------------------------
'EOR
**************
* MACRO  36 *
**************
*          2000200002000
1          TWO DIMENSIONS
1          (1.+(&B))UXX$ + (1./(X+(&A))**2)UYY$ + (2./(X+(&A)))UX$ +
1.         E(X,Y)UY$ = F(X,Y)
2          DIRICHLET
2          X=0. , U=TRUE(X,Y)
2          X=1. , U=TRUE(X,Y)
2          Y=0. , U=TRUE(X,Y)
2          Y=1. , U=TRUE(X,Y)
3     FUNCTION TRUE(X,Y)
3     TRUE = (1.-(&B))*EXP(X+Y)
3     IF (X+(&A) .NE. 0.) TRUE = TRUE + (&B)*ALOG(X+(&A))
3     RETURN
3     END
3     FUNCTION E(X,Y)
3     E = 1./((X+(&A))*TAN(Y))
3     RETURN
3     END
3     FUNCTION F(X,Y)
3     TEMP = (1.-(&B))*EXP(X+Y)
3     UX = TEMP + (&B)/(X+(&A))
3     UXX= TEMP - (&B)/(X+(&A))**2
3     UY = TEMP
3     UYY= TEMP
3     F = (1.+(&B))*UXX + 1./(X+(&A))**2*UYY +
3    $    2./(X+(&A))*UX + E(X,Y)*UY
3     RETURN
3     END
-------------------------------------------------------------------------------
'EOR
**************
* MACRO  37 *
**************
-------------------------------------------------------------------------------
'EOR
**************
* MACRO  38 *
**************
*          2022021200200
1          TWO DIMENSIONS $ CONSTANT COEFFICIENTS $ HOMOGENEOUS
1          POISSON $ LAPLACE
1          UXX$ + UYY$ = 0.
2          X=-1.570796327 , U =TRUE(X,Y)
2          X= 1.570796327 , U =TRUE(X,Y)
2          Y= 0.          , UY=G(X)
2          Y= 1.          , U =TRUE(X,Y)
3     FUNCTION TRUE(X,Y)
3     TEMP = 2.*(&A) + 1.
3     TRUE = EXP(-SQRT(TEMP))*COS(TEMP*X)*SINH(TEMP*Y)/TEMP
3     RETURN
3     END
3     FUNCTION G(X)
3     TEMP = 2.*(&A) + 1.
3     G = EXP(-SQRT(TEMP))*COS(TEMP*X)
3     RETURN
3     END
3     FUNCTION SINH(X)
3     EXPX = EXP(X)
3     SINH = 0.5*(EXPX - 1./EXPX)
```

```
3      RETURN
3      END
------------------------------------------------------------------------
*EOR
[illegible]
[illegible] MACRO 33 [illegible]
[illegible]
*           [illegible]1000100
1           [illegible]
1           [illegible] + (1.-H(X)**2*U(X,Y)**2)/&3)US = 0.
2           DIRICHLET
2           [illegible]=1. , U=1.0
2           [illegible]=1. , U=1.0
2           [illegible]=1. , U=1.0
2           [illegible]=1. , U=1.0
3      FUNCTION [illegible](X,Y)
CC
CC     ****************************************************
CC     *                                                  *
CC     *              MACRO 33 PARAMETERS                 *
CC     *                                                  *
CC     ****************************************************
CC     *                                                  *
CC     *               N  I     D    I    H(X)            *
CC     *              ----I---------I----------           *
CC     *               1  I   0.50   I    1/X             *
CC     *                  I          I                    *
CC     *               2  I   1.00   I    1/X             *
CC     *                  I          I                    *
CC     *               3  I   0.25   I   EXP(X)           *
CC     *                  I          I                    *
CC     *               4  I   0.50   I   EXP(X)           *
CC     *                  I          I                    *
CC     *               5  I   1.00   I   EXP(X)           *
CC     *                                                  *
CC     ****************************************************
CC
3      REAL DERVBL(5), GRID(20), TABLE(20,20),
3     $     T131(100), T132(100), T133(100), T134(100),
3     $     T231(100), T232(100), T233(100), T234(100),
3     $     T331(100), T332(100), T333(100), T334(100),
3     $     T431(100), T432(100), T433(100), T434(100),
3     $     T531(100), T532(100), T533(100), T534(100)
3      EQUIVALENCE (TABLE(1, 1) , T&A31(1)),
3     $             (TABLE(1, 6) , T&A32(1)),
3     $             (TABLE(1,11) , T&A33(1)),
3     $             (TABLE(1,16) , T&A34(1))
3      DATA NGRID, [illegible], GRID /20, 20, 0.0000000, 0.0526316,
3     $0.1052632, 0.1578947, 0.2105263, 0.2631579, 0.3157895,
3     $0.3684211, 0.4210526, 0.4736842, 0.5263158, 0.5789474,
3     $0.6315789, 0.6842105, 0.7368421, 0.7894737, 0.8421053,
3     $0.8947368, 0.9473684, 1.0000000/
CC
CC     [illegible] SOLUTION OF LINEARIZED PROBLEM USING
CC     [illegible] ([illegible], [illegible]=4, 20 X 20 GRID)
CC
3      DATA T131/ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
3     $ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
3     $ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
3     $ 1.000000, 1.000000, 1.000000, 1.000000,  .314500,  .670366,
3     $  [illegible],  [illegible],  [illegible],  [illegible],  .891357,  .908003,
3     $  [illegible],  [illegible],  [illegible],  [illegible],  .931733,  .939219,
3     $  [illegible],  [illegible],  [illegible],  [illegible], 1.000000, 1.000000,
3     $  [illegible],  [illegible],  [illegible],  [illegible],  .741633,  .779089,
3     $  [illegible],  [illegible],  [illegible],  [illegible],  .893692,  .914600,
3     $  [illegible],  [illegible],  [illegible],  [illegible],  .976571,  .989926,
3     $ 1.000000, 1.000000,  [illegible],  [illegible],  .570661,  .628200,
3     $  [illegible],  [illegible],  [illegible],  [illegible],  .811633,  .837391,
3     $  [illegible],  [illegible],  [illegible],  [illegible],  .938065,  .954418,
3     $  [illegible],  [illegible], 1.000000, 1.000000,  .551043,  .595408,
3     $  [illegible],  [illegible],  [illegible],  [illegible],  .707033,  .742039,
3     $  [illegible],  [illegible],  [illegible],  [illegible],  .830431,  .860067,
3     $  [illegible],  [illegible],  [illegible],  .931000, 1.000000/
CC
3      DATA T132/ 1.000000,  [illegible],  [illegible],  .533003,  .560075,
3     $  [illegible],  [illegible],  [illegible],  [illegible],  .746333,  .777630,
```

```
3     5 .830045, .836307, .892929, .838105, .912948, .934972,
      5 .957103, .970897, 1.000000, 1.000000, .550434, .494926,
      5 [illegible], .514175, .579049, .616083, .653410, .689916,
      5 [illegible], .753534, [illegible], .820747, .849439, .876857,
      5 [illegible], .933193, [illegible], .976435, 1.000000, 1.000000,
      5 [illegible], .402412, .509223, .534235, .566524, .601931,
      5 [illegible], .674050, .710490, .744904, .777937, .809539,
      5 [illegible], .888335, .898434, .922233, .949268, .974773,
      5 1.[illegible], 1.000000, .551677, .491270, .504943, .528520,
3     5 [illegible], .630351, .680234, .685477, .701274, .736159,
3     5 [illegible], .810292, .833423, .853325, .892124, .916980,
3     5 [illegible], .970522, 1.000000, 1.000000, .551712, .490681,
3     5 [illegible], .525831, .555813, .589235, .624331, .660951,
3     5 [illegible], .751333, .785320, .723735, .830309, .860691,
3     5 [illegible], .913371, .949013, .973141, 1.000000/
CC
3       DATA T[illegible]/ 1.000000, .551712, .490681, .503001, .525881,
3     5 [illegible], .[illegible]3, .624331, .660951, .695309, .731899,
3     5 [illegible], .[illegible]4, .830309, .860691, .889394, .918371,
3     5 .9[illegible], .975141, 1.000000, 1.000000, .551677, .491270,
3     5 [illegible], .[illegible]520, .728112, .683351, .629234, .665477,
3     5 [illegible], .[illegible]159, .733337, .802292, .833423, .863325,
3     5 [illegible], .913330, .947031, .973382, 1.000000, 1.000000,
3     5 [illegible], .[illegible]412, .509223, .534235, .566524, .601931,
3     5 [illegible], .674330, .710423, .744904, .777937, .809539,
3     5 [illegible], .[illegible]335, .898434, .923233, .949268, .974773,
3     5 1.[illegible], 1.000000, .550434, .494926, .514740, .544175,
3     5 [illegible], .[illegible]6096, .653410, .689916, .725058, .758604,
3     5 [illegible], .[illegible]743, .849439, .876857, .903027, .928198,
3     5 .97[illegible], .978425, 1.000000, 1.000000, .550152, .499893,
3     5 [illegible], .530375, .580045, .637904, .675565, .711758,
3     5 [illegible], .777889, .803045, .836307, .862923, .888105,
3     5 .[illegible], .934972, .957103, .973897, 1.000000/
CC
3       DATA T[illegible]/ 1.000000, .551048, .509458, .545252, .585293,
3     5 .[illegible]1, .663069, .707008, .742029, .774235, .803698,
3     5 .[illegible]07, .855723, .830431, .902567, .923671, .943671,
3     5 [illegible], .931550, 1.000000, 1.000000, .556496, .529392,
3     5 .570261, .638203, .673663, .714454, .750711, .782923,
3     5 .811636, .837531, .861095, .882600, .902424, .920837,
3     5 [illegible], .954419, .970031, .985146, 1.000000, 1.000000,
3     5 .550[illegible], .567450, .640266, .695171, .741633, .779069,
3     5 .81[illegible], .837105, .860150, .880369, .898332, .914608,
3     5 [illegible], .942220, .955513, .967335, .978571, .989396,
3     5 1.[illegible], 1.000000, .614500, .678566, .761544, .808864,
3     5 [illegible], .870739, .891357, .908065, .921983, .933918,
3     5 [illegible], .953409, .961733, .968219, .973105, .982513,
3     5 [illegible], .[illegible]58, 1.000000, 1.000000, 1.000000, 1.000000,
3     5 1.000000, 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
3     5 1.000000, 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
3     5 1.000000, 1.000000, 1.000000, 1.000000, 1.000000/
CC
3       DATA T[illegible]/ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
3     5 1.000000, 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
3     5 1.000000, 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
3     5 1.000000, 1.000000, 1.000000, 1.000000, .741503, .778382,
3     5 [illegible], .[illegible]57, .[illegible]719, .909133, .923739, .935611,
3     5 [illegible], .[illegible]31, .961[illegible], .967719, .973492, .978713,
3     5 [illegible], .[illegible]22, .[illegible]103, .983103, 1.000000, 1.000000,
3     5 [illegible], .[illegible]113, .[illegible]431, .778523, .812321, .840174,
3     5 [illegible], .[illegible]155, .[illegible]50, .914391, .927376, .939678,
3     5 [illegible], .[illegible]375, .[illegible]17, .977140, .985018, .992590,
3     5 1.[illegible], 1.[illegible], .675673, .650231, .655324, .722473,
3     5 [illegible], .[illegible]5, .[illegible]43, .841284, .863046, .882481,
3     5 [illegible], .[illegible]13, .[illegible]203, .948509, .959046, .987705,
3     5 [illegible], .[illegible]9, 1.000000, 1.000000, .559171, .620817,
3     5 .58[illegible]0, .[illegible]430, .716622, .751595, .781344, .808813,
3     5 [illegible], .[illegible]177, .873322, .895873, .913563, .929909,
3     5 [illegible], .[illegible]35, .973[illegible], .989954, 1.000000/
CC
3       DA[illegible]/ 1.[illegible], .[illegible]353, .[illegible]755, .637101, .663405,
3     5 [illegible], .[illegible], .755119, .[illegible]3437, .810503, .835301,
3     5 .[illegible]3, .[illegible]1[illegible], .[illegible]43, .910331, .938336, .953022,
3     5 [illegible], .[illegible], 1.000000, 1.000000, .559044, .615183,
3     5 [illegible], .[illegible], .[illegible]213, .755131, .733197, .765037,
3     5 [illegible], .[illegible]3, .[illegible], .[illegible]390, .880284, .905314,
```

```
      3     $  .872249,  .947760,  .965578,  .982914, 1.000000, 1.000000,
      3     $  .665755,  .712102,  .819783,  .839231,  .864970,  .893619,
      3     $  .723193,  .752532,  .780972,  .808175,  .833992,  .858400,
      3     $  .831453,  .903280,  .924017,  .943849,  .962975,  .981613,
      3     $ 1.000000, 1.000000,  .665912,  .610520,  .616112,  .633757,
      3     $  .633123,  .665901,  .715069,  .744391,  .773116,  .800823,
      3     $  .820232,  .852449,  .876315,  .898976,  .920569,  .941262,
      3     $  .961251,  .980752, 1.000000, 1.000000,  .665795,  .609738,
      3     $  .614414,  .631208,  .654903,  .682225,  .711162,  .740445,
      3     $  .769284,  .797218,  .823993,  .849509,  .873767,  .896840,
      3     $  .918355,  .939975,  .960392,  .980322, 1.000000/
C
      3      DATA T2B3/ 1.000000,  .665795,  .609733,  .614414,  .631208,
      3     $  .654903,  .682225,  .711162,  .740445,  .769284,  .797218,
      3     $  .823993,  .849509,  .873767,  .896240,  .918855,  .939975,
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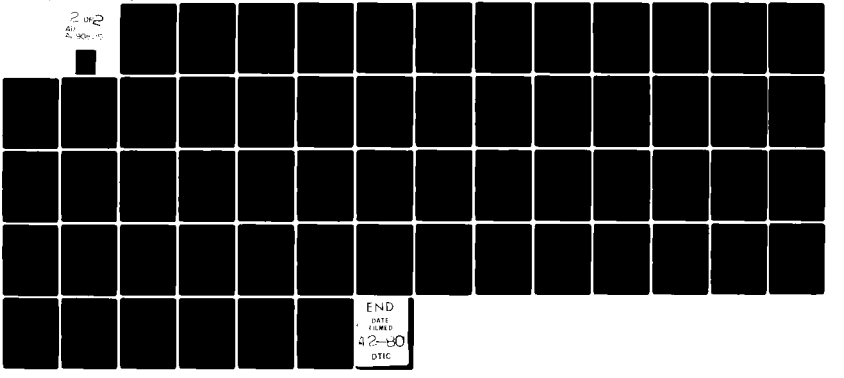
AD-A090 825 WISCONSIN UNIV-MADISON MATHEMATICS RESEARCH CENTER F/G 12/1
A POPULATION OF LINEAR, SECOND ORDER ELLIPTIC PARTIAL DIFFERENT--ETC(U)
MAY 80 J R RICE, E N HOUSTIS, W R DYKSEN DAAG29-80-C-0041
UNCLASSIFIED MRC-TSR-2079 NL



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3     $  .820182,  .888353, 1.000000, 1.000000,  .974120,  .948385,
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3      DATA T3B3/ 1.000000,  .974120,  .948385,  .922953,  .897989,
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3     $ 1.000000, 1.000000,  .976808,  .953708,  .930817,  .908259,
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3     $  .906852,  .899052,  .892342,  .888806,  .887279,  .889173,
3     $  .895517,  .907672,  .927379,  .957054, 1.000000, 1.000000,
3     $  .989442,  .978888,  .968361,  .957902,  .947575,  .937476,
3     $  .927729,  .918506,  .910031,  .902587,  .895545,  .892375,
3     $  .890697,  .892310,  .898239,  .909848,  .928895,  .957830,
3     $ 1.000000, 1.000000,  .990132,  .980261,  .970401,  .960588,
3     $  .950878,  .941353,  .932129,  .923360,  .915254,  .908072,
3     $  .902163,  .897969,  .896085,  .897289,  .902587,  .913348,
3     $  .931351,  .959097, 1.000000, 1.000000,  .991070,  .982128,
3     $  .973182,  .964256,  .955396,  .946673,  .938185,  .930069,
3     $  .922506,  .915730,  .910056,  .905888,  .903779,  .904464,
3     $  .908919,  .918496,  .934995,  .960986, 1.000000/
3C
3      DATA T5B4/ 1.000000,  .992271,  .984521,  .976750,  .968973,
3     $  .961223,  .953559,  .945057,  .938831,  .932034,  .925861,
3     $  .920583,  .916549,  .914251,  .914356,  .917772,  .925800,
3     $  .940237,  .963735, 1.000000, 1.000000,  .993750,  .987472,
3     $  .981160,  .974819,  .968472,  .962159,  .955939,  .949896,
3     $  .944149,  .938849,  .934210,  .930512,  .928155,  .927703,
3     $  .929942,  .936052,  .947751,  .967740, 1.000000, 1.000000,
3     $  .995523,  .991017,  .986469,  .981881,  .977264,  .972643,
3     $  .968054,  .963553,  .959221,  .955157,  .951509,  .948470,
3     $  .946328,  .945492,  .946555,  .950453,  .958648,  .973717,
3     $ 1.000000, 1.000000,  .997605,  .995186,  .992734,  .990248,
3     $  .987731,  .985194,  .982652,  .980134,  .977678,  .975333,
3     $  .973174,  .971293,  .969844,  .969042,  .969210,  .970876,
3     $  .974928,  .983205, 1.000000, 1.000000, 1.000000, 1.000000,
3     $ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
3     $ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
3     $ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000/
3C
3C     INTERPOLATE NONLINEAR SOLUTION BY QUADRATICS
3C
3      CALL QUADRD(X,Y,TABLE,GRID,GRID,NGRID,NGRID,NGRDD,NGRDD,DERVSL)
3C
3      TRUE = DERVSL(6)
3C
3      RETURN
3      END
3      FUNCTION H(X)
3      GO TO(10,10,20,20,20),&A
3   10 H = 0.0
3      IF (X .NE. 0.) H = 1./X
3      RETURN
3   20 H = EXP(X)
3      RETURN
3      END
3      FUNCTION W(X,Y)
3C
3      REAL DERVSL(6), GRID(9), TAB1(9,9), TAB2(9,9),
3     $     TAB3(9,9), TAB4(9,9), TAB5(9,9)
3      DATA NGRID, NGRDD, GRID /9, 9, 0., 0.125, 0.250,
3     $0.375, 0.500, 0.625, 0.750, 0.875, 1.00/
3C
3C     APPROXIMATE SOLUTION OF NONLINEAR PROBLEM FOR NONLINEAR
3C     COLLOCATION
3C
3      DATA TAB1/ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
3     $ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,  .506876,
3     $  .667850,  .769627,  .839584,  .891757,  .933243,  .968259,
3     $ 1.000000, 1.000000,  .410154,  .535076,  .650126,  .744913,
3     $  .822954,  .888785,  .946495, 1.000000, 1.000000,  .381814,
3     $  .483191,  .594221,  .696058,  .785410,  .863715,  .933997,
3     $ 1.000000, 1.000000,  .374994,  .469323,  .577958,  .681090,
3     $  .773552,  .855656,  .929943, 1.000000, 1.000000,  .381814,
3     $  .483191,  .594221,  .696058,  .785411,  .863715,  .933997,
3     $ 1.000000, 1.000000,  .410154,  .535076,  .650126,  .744914,
3     $  .822954,  .888785,  .946495, 1.000000, 1.000000,  .506876,
3     $  .667850,  .769628,  .839585,  .891758,  .933243,  .968259,
3     $ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
3     $ 1.000000, 1.000000, 1.000000, 1.000000/
```

```
3C
3      DATA TAB2/ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
3     $ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,  .602893,
3     $  .739247,  .822810,  .878615,  .919148,  .950600,  .976638,
3     $ 1.000000, 1.000000,  .512695,  .621554,  .720883,  .800325,
3     $  .863629,  .915379,  .959599, 1.000000, 1.000000,  .485164,
3     $  .573183,  .670610,  .757792,  .831835,  .894601,  .949386,
3     $ 1.000000, 1.000000,  .478416,  .559979,  .655650,  .744447,
3     $  .821555,  .887770,  .946000, 1.000000, 1.000000,  .485164,
3     $  .573183,  .670609,  .757791,  .831834,  .894601,  .949387,
3     $ 1.000000, 1.000000,  .512695,  .621554,  .720882,  .800324,
3     $  .863628,  .915379,  .959599, 1.000000, 1.000000,  .602893,
3     $  .739248,  .822809,  .878615,  .919148,  .950601,  .976638,
3     $ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
3     $ 1.000000, 1.000000, 1.000000, 1.000000/
3C
3      DATA TAB3/ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
3     $ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,  .969133,
3     $  .938216,  .907820,  .879233,  .855269,  .842995,  .863848,
3     $ 1.000000, 1.000000,  .950959,  .902895,  .857303,  .816798,
3     $  .786550,  .778103,  .820581, 1.000000, 1.000000,  .941574,
3     $  .884947,  .832317,  .787160,  .755922,  .751881,  .805331,
3     $ 1.000000, 1.000000,  .938692,  .879478,  .824808,  .778445,
3     $  .747215,  .744783,  .801431, 1.000000, 1.000000,  .941574,
3     $  .884947,  .832318,  .787160,  .755922,  .751882,  .805331,
3     $ 1.000000, 1.000000,  .950960,  .902895,  .857303,  .816799,
3     $  .786551,  .778103,  .820582, 1.000000, 1.000000,  .969133,
3     $  .938217,  .907820,  .879233,  .855269,  .842995,  .863848,
3     $ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
3     $ 1.000000, 1.000000, 1.000000, 1.000000/
3C
3      DATA TAB4/ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
3     $ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,  .979728,
3     $  .959246,  .938933,  .919863,  .904380,  .897858,  .914513,
3     $ 1.000000, 1.000000,  .966833,  .933969,  .902427,  .874367,
3     $  .854068,  .850356,  .882916, 1.000000, 1.000000,  .959791,
3     $  .920374,  .883276,  .851374,  .830024,  .829479,  .870497,
3     $ 1.000000, 1.000000,  .957565,  .916106,  .877340,  .844387,
3     $  .822928,  .823561,  .867130, 1.000000, 1.000000,  .959792,
3     $  .920374,  .883276,  .851374,  .830024,  .829479,  .870497,
3     $ 1.000000, 1.000000,  .966833,  .933969,  .902427,  .874367,
3     $  .854068,  .850356,  .882916, 1.000000, 1.000000,  .979728,
3     $  .959246,  .938933,  .919863,  .904380,  .897858,  .914513,
3     $ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
3     $ 1.000000, 1.000000, 1.000000, 1.000000/
3C
3      DATA TAB5/ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
3     $ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,  .987658,
3     $  .975113,  .962598,  .950876,  .941611,  .938390,  .949788,
3     $ 1.000000, 1.000000,  .979429,  .958883,  .938986,  .921260,
3     $  .908740,  .907369,  .929229, 1.000000, 1.000000,  .974782,
3     $  .949842,  .926125,  .905660,  .892267,  .892922,  .920524,
3     $ 1.000000, 1.000000,  .973287,  .946951,  .922060,  .900817,
3     $  .887281,  .888697,  .918071, 1.000000, 1.000000,  .974783,
3     $  .949843,  .926125,  .905650,  .892266,  .892921,  .920524,
3     $ 1.000000, 1.000000,  .979431,  .958885,  .938987,  .921259,
3     $  .908738,  .907368,  .929228, 1.000000, 1.000000,  .987659,
3     $  .975115,  .962599,  .950875,  .941609,  .938389,  .949788,
3     $ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
3     $ 1.000000, 1.000000, 1.000000, 1.000000/
3C
3C     INTERPOLATE NONLINEAR SOLUTION BY QUADRATICS
3C
3      CALL QUADRD(X,Y,TAB&A,GRID,GRID,NGRID,NGRID,NGRDD,NGRDD,DERVSL)
3C
3      W = DERVSL(6)
3C
3      RETURN
3      END
```

```
'EOR
*************
* MACRO  40 *
*************
*          2000200000020
1          TWO DIMENSIONS
```

```
1          UXX$ + (1.+X**2)UYY$ - (Y)UX$ = F(X,Y)
2          MIXED
2          X=0. , MIXED = (&A)U + (&B)UX = G(X,Y)
2          X=1. , MIXED = (&A)U + (&B)UX = G(X,Y)
2          Y=0. , U=TRUE(X,Y)
2          Y=1. , U=TRUE(X,Y)
3      FUNCTION TRUE(X,Y)
3      V = (X+Y)/(2.+X-Y)
3      U1 = EXP(2.*V-2.)
3      W  = (X+1.)/(Y+1.)
3      U2 = ALOG10(W)
3      TRUE = U1 + U2
3      RETURN
3      END
3      FUNCTION F(X,Y)
3      DATA ALOGE10/2.3025850929940/
3      V   = (X+Y)/(2.+X-Y)
3      VX  = 2.*(1.-Y)/(2.+X-Y)**2
3      VXX = 4.*(Y-1.)/(2.+X-Y)**3
3      VY  = 2.*(1.+X)/(2.+X-Y)**2
3      VYY = 4.*(1.+X)/(2.+X-Y)**3
3      U1   = EXP(2.*V-2.)
3      U1X  = 2.*VX*U1
3      U1XX = 2.*(VXX + 2.*VX**2)*U1
3      U1Y  = 2.*VY*U1
3      U1YY = 2.*(VYY + 2.*VY**2)*U1
3      W   = (X+1.)/(Y+1.)
3      WX  = 1./(Y+1.)
3      WY  = -(X+1.)/(Y+1.)**2
3      WYY = 2.*(X+1.)/(Y+1.)**3
3      U2   = ALOG10(W)
3      U2X  = (WX/W)/ALOGE10
3      U2XX = (-(WX/W)**2)/ALOGE10
3      U2Y  = (WY/W)/ALOGE10
3      U2YY = (WYY/W - (WY/W)**2)/ALOGE10
3      UX  = U1X + U2X
3      UXX = U1XX + U2XX
3      UYY = U1YY + U2YY
3      F = UXX + (1.+X**2)*UYY - Y*UX
3      RETURN
3      END
3      FUNCTION G(X,Y)
3      DATA ALOGE10/2.3025850929940/
3      V = (X+Y)/(2.+X-Y)
3      VX = 2.*(1.-Y)/(2.+X-Y)**2
3      U1 = EXP(2.*V-2.)
3      U1X = 2.*VX*U1
3      W = (X+1.)/(Y+1.)
3      WX = 1./(Y+1.)
3      U2 = ALOG10(W)
3      U2X = (WX/W)/ALOGE10
3      U = U1 + U2
3      UX = U1X + U2X
3      G = &A*U + (&B)*UX
3      RETURN
3      END
```

```
'EOR
*************
* MACRO  41 *
*************
*          2000021002002
1          TWO DIMENSIONS $ CONSTANT COEFFICIENTS
1          UXX$ + UYY$ + (&A)U$ = F(X,Y)
2          DIRICHLET $ HOMOGENEOUS
2          X=0. ,                    U=0.
2          X=3.14159265358979 ,  U=0.
2          Y=0. ,                    U=0.
2          Y=3.14159265358979 ,  U=0.
3      FUNCTION TRUE(X,Y)
3      DATA PI/3.14159265358979/
3      SUM = 0.
3      DO 100 K = 1,&B
3          TEMP = 2.*K - 1.
3          SUM  = SUM + SIN(TEMP*X)*COSH(TEMP*(Y-PI*.5))/
3     $                 (TEMP**3*COSH(TEMP*PI*.5))
```

```
3 100 CONTINUE
3     TRUE = .5*X*(PI-X) - 4./PI*SUM
3     RETURN
3     END
3     FUNCTION F(X,Y)
3     F = -1. +(&A)*TRUE(X,Y)
3     RETURN
3     END
3     FUNCTION COSH(X)
3     EXPX = EXP(X)
3     COSH = 0.5*(EXPX + 1./EXPX)
3     RETURN
3     END
-------------------------------------------------------------------------------
'EOR
*************
* MACRO  42 *
*************
*         2000220200200
1         TWO DIMENSIONS $ CONSTANT COEFFICIENTS
1         UXX$ + UYY$ + UY$ - U$ = 0.
2         NEUMANN
2         X=&A , UX = -G1(X,Y)
2         X=&B , UX =  G1(X,Y)
2         Y=0. , UY = -G2(X,Y)
2         Y=1. , UY =  G2(X,Y)
3     FUNCTION TRUE(X,Y)
3     COMMON /CONCOM/ PI
3     DATA PI/3.14159265358979/
3     F0 = (&C)*PI/((&B)-(&A))
3     F1 = SQRT(5./4. +F0*F0)
3     TRUE = EXP(-Y*.5)*SINH(F1*Y)*SIN(F0*(X-(&A)))
3     RETURN
3     END
3     FUNCTION G1(X,Y)
3     COMMON /CONCOM/PI
3     F0 = (&C)*PI/((&B)-(&A))
3     F1 = SQRT(5./4. +F0*F0)
3     G1 = EXP(-Y*.5)*SINH(F1*Y)*F0*COS(F0*(X-(&A)))
3     IF (ABS(X-(&A)) .LT. 1.E-7) G1 = -1.*G1
3     RETURN
3     END
3     FUNCTION G2(X,Y)
3     COMMON /CONCOM/PI
3     F0 = (&C)*PI/((&B)-(&A))
3     F1 = SQRT(5./4. +F0*F0)
3     G2 = -.5*TRUE(X,Y) + F1*EXP(-Y*.5)*COSH(F1*Y)*
3    $     SIN(F0*(X-(&A)))
3      IF (Y .EQ. 0.) G2 = -1.*G2
3     RETURN
3     END
3     FUNCTION SINH(X)
3     EXPX = EXP(X)
3     SINH = 0.5*(EXPX - 1./EXPX)
3     RETURN
3     END
3     FUNCTION COSH(X)
3     EXPX = EXP(X)
3     COSH = 0.5*(EXPX + 1./EXPX)
3     RETURN
3     END
-------------------------------------------------------------------------------
'EOR
*************
* MACRO  43 *
*************
-------------------------------------------------------------------------------
'EOR
*************
* MACRO  44 *
*************
*         2000001002002
1         TWO DIMENSIONS
1         UXX$ + UYY$ + W(X,Y)U$ = W(X,Y)
2         DIRICHLET $ HOMOGENEOUS
2         X=0. , U=0.
```

```
      X=1. . U=0.
      Y=0. . U=0.
      Y=1. . U=0.
    FUNCTION TRUE(X,Y)

C*****************************************************
C*                                                   *
C*               MACRO 44 PARAMETERS                 *
C*                                                   *
C*****************************************************
C*                                                   *
C*          A    I  B  I   C   I   D   I  E          *
C*       -------I-----I-------I------I-----           *
C*         1.425  I  1  I  .50  I   2  I  1          *
C*                I     I      I      I               *
C*        10.000  I  1  I  .50  I   2  I  2          *
C*                I     I      I      I               *
C*         1.425  I  2  I  .04  I  25  I  3          *
C*                I     I      I      I               *
C*         1.425  I  2  I  .50  I   2  I  4          *
C*                                                   *
C*****************************************************
C
      REAL DERUSL(6), GRID(20), TABLE(20,20),
     $     T1B1(100), T1B2(100), T1B3(100), T1B4(100),
     $     T2B1(100), T2B2(100), T2B3(100), T2B4(100),
     $     T3B1(100), T3B2(100), T3B3(100), T3B4(100),
     $     T4B1(100), T4B2(100), T4B3(100), T4B4(100)
      EQUIVALENCE (TABLE(1, 1) , T&EB1(1)),
     $            (TABLE(1, 6) , T&EB2(1)),
     $            (TABLE(1,11) , T&EB3(1)),
     $            (TABLE(1,16) , T&EB4(1))
      DATA NGRID, NGRDD, GRID /20, 20, 0.0000000, 0.0526316,
     $0.1052632, 0.1578947, 0.2105263, 0.2631579, 0.3157895,
     $0.3684211, 0.4210526, 0.4736842, 0.5263158, 0.5789474,
     $0.6315789, 0.6842105, 0.7368421, 0.7894737, 0.8421053,
     $0.8947368, 0.9473684, 1.0000000/

C
C     APPROXIMATE SOLUTION OF LINEARIZED PROBLEM USING
C     HODIE-HOF (METHOD=4, IORDER=41, 20 X 20 GRID)
C
      DATA T1B1/ .000000,  .000000,  .000000,  .000000,  .000000,
     $  .000000,  .000000,  .000000,  .000000,  .000000,
     $  .000000,  .000000,  .000000,  .000000,  .000000,
     $  .000000,  .000000,  .000000,  .009616,  .016256,
     $  .021191,  .024955,  .027830,  .029984,  .032514,
     $  .033001,  .033001,  .032514,  .031522,  .029984,  .027830,
     $  .024955,  .021191,  .016256,  .009616,  .000000,  .000000,
     $  .016256,  .028498,  .037893,  .045161,  .050752,  .054957,
     $  .057963,  .059913,  .060866,  .060866,  .059913,  .057968,
     $  .054957,  .050752,  .045161,  .037293,  .028493,  .016256,
     $  .000000,  .000000,  .021191,  .037833,  .051061,  .061406,
     $  .069435,  .075507,  .079859,  .082590,  .084076,  .084076,
     $  .082590,  .079859,  .075507,  .069435,  .061406,  .051061,
     $  .037833,  .021191,  .000000,  .000000,  .024955,  .045161,
     $  .061406,  .074337,  .084461,  .092159,  .097710,  .101308,
     $  .103078,  .103078,  .101308,  .097710,  .092159,  .084461,
     $  .074337,  .061406,  .045161,  .024955,  .000000/
C
      DATA T1B2/ .000000,  .027830,  .050752,  .069435,  .084461,
     $  .095812,  .105363,  .111921,  .116179,  .118274,  .118274,
     $  .116179,  .111921,  .105363,  .095812,  .084461,  .069435,
     $  .050752,  .027830,  .000000,  .000000,  .023984,  .054957,
     $  .075507,  .092159,  .105363,  .115506,  .122852,  .127650,
     $  .130010,  .130010,  .127650,  .122852,  .115506,  .105368,
     $  .092159,  .075507,  .054957,  .023984,  .000000,        0,
     $  .031522,  .057963,  .079859,  .097710,  .111921,  .122852,
     $  .130819,  .133006,  .133564,  .133564,  .133006,  .130819,
     $  .122852,  .111921,  .097710,  .079859,  .057963,  .031522,
     $  .000000,  .000000,  .032514,  .059813,  .082590,  .101308,
     $  .116179,  .127650,  .133006,  .111459,  .144150,  .144150,
     $  .141459,  .133006,  .127650,  .116179,  .101308,  .082690,
     $  .059813,  .032514,  .000000,  .000000,  .033001,  .060866,
     $  .084076,  .103078,  .118274,  .130010,  .133564,  .144150,
     $  .146007,  .146007,  .111459,  .133564,  .130010,  .118274,
     $  .103078,  .084076,  .060866,  .033001,  .000000/
```

```
3C
3      DATA T1B3/  .000000,  .033001,  .060866,  .084076,  .103078,
3     $  .118274,  .130010,  .138564,  .144150,  .146907,  .146907,
3     $  .144150,  .138564,  .130010,  .118274,  .103078,  .084076,
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3     $  .111481,  .101821,  .083185,  .073187,  .053353,  .029169,
3     $  .000000,  .000000,  .030040,  .055053,  .075332,  .092338,
3     $  .105510,  .115370,  .123001,  .127735,  .130110,  .130110,
3     $  .127735,  .123001,  .115370,  .105549,  .092333,  .075662,
3     $  .053153,  .030010,  .000000,  .000000,  .030435,  .055903,
3     $  .073371,  .092335,  .107379,  .117723,  .123232,  .130110,
3     $  .132513,  .132513,  .130110,  .123232,  .117723,  .107379,
3     $  .093333,  .076374,  .055303,  .030435,  .000000/
3C
3      DATA T43A/  .000000,  .030435,  .055303,  .076374,  .093385,
3     $  .107379,  .117723,  .123232,  .130110,  .132513,  .132513,
3     $  .130110,  .123232,  .117723,  .107379,  .093385,  .076374,
3     $  .055303,  .030040,  .000000,  .000000,  .030040,  .055069,
3     $  .075332,  .092338,  .105549,  .115370,  .123001,  .127735,
3     $  .130110,  .130110,  .127735,  .123001,  .115370,  .105549,
3     $  .092333,  .075662,  .055039,  .030040,  .000000,  .000000,
3     $  .073153,  .053353,  .029169,  .000000,  .030040,  .055039,
3     $  .073187,  .083185,  .101821,  .111481,  .118466,  .123001,
3     $  .123232,  .123232,  .123001,  .118466,  .111481,  .101821,
3     $  .083185,  .073187,  .053353,  .029169,  .000000,  .030040,
3     $  .055053,  .073187,  .083185,  .101821,  .111481,  .115670,
3     $  .117723,  .117723,  .115670,  .111481,  .101821,  .083185,
3     $  .073187,  .053343,  .050706,  .027811,  .000000,  .000000,
3     $  .083043,  .084233,  .083053,  .105018,  .111481,  .115670,
```

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     $  .099033,  .105013,  .111481,  .116670,  .117729,  .117729,
     $  .116670,  .111481,  .105013,  .099033,  .084293,  .069343,
     $  .030736,  .027311,  .000000,  .000000,  .025396,  .046971,
     $  .069338,  .077475,  .083044,  .083058,  .101021,  .105549,
     $  .103379,  .103379,  .103513,  .101021,  .083058,  .088044,
     $  .077475,  .069338,  .046971,  .025396,  .000000/
3C
      DATA TAB4/  .000000,  .023316,  .041959,  .056770,  .068432,
     $  .077475,  .084293,  .089185,  .092338,  .093835,  .093885,
     $  .092333,  .089185,  .084223,  .077475,  .068432,  .056770,
     $  .041959,  .023316,  .000000,  .000000,  .019900,  .035373,
     $  .047417,  .056770,  .063336,  .068343,  .073187,  .075662,
     $  .076874,  .076874,  .075662,  .073187,  .068343,  .063956,
     $  .056770,  .047417,  .035373,  .019900,  .000000,  .000000,
     $  .015360,  .028754,  .035373,  .041959,  .046971,  .050706,
     $  .053363,  .055069,  .055903,  .055903,  .055069,  .053363,
     $  .050706,  .046971,  .041959,  .035373,  .028754,  .015360,
     $  .000000,  .000000,  .009154,  .015360,  .019900,  .023316,
     $  .025396,  .027811,  .029169,  .030040,  .030465,  .030465,
     $  .030040,  .029169,  .027811,  .025396,  .023316,  .019900,
     $  .015360,  .009154,  .000000,  .000000,  .000000,  .000000,
     $  .000000,  .000000,  .000000,  .000000,  .000000,  .000000,
     $  .000000,  .000000,  .000000,  .000000,  .000000,  .000000,
     $  .000000,  .000000,  .000000,  .000000,  .000000/
3C
3C    INTERPOLATE NONLINEAR SOLUTION BY QUADRATICS
3C
      CALL QUADRD(X,Y,TABLE,GRID,GRID,NGRID,NGRID,NGRDD,NGRDD,DERVSL)
3C
      TRUE = DERVSL(6)
3C
      RETURN
      END
      FUNCTION W(X,Y)
3C
      REAL DERVSL(6), GRID(9), TAB1(9,9), TAB2(9,9),
     $     TAB3(9,9), TAB4(9,9)
      DATA NGRID, NGRDD, GRID /9, 9, 0., 0.125, 0.250,
     $0.375, 0.500, 0.625, 0.750, 0.875, 1.00/
3C
3C    APPPOXIMATE SOLUTION OF NONLINEAR PROBLEM FOR NONLINEAR
3C    COLLOCATION
3C
      DATA TAB1/  .000000,  .000000,  .000000,  .000000,  .000000,
     $  .000000,  .000000,  .000000,  .000000,  .000000,  .036712,
     $  .036745,  .067036,  .070223,  .067036,  .036745,  .036712,
     $  .000000,  .000000,  .036745,  .091025,  .109316,  .115060,
     $  .109316,  .091025,  .036745,  .000000,  .000000,  .067036,
     $  .109316,  .132414,  .133733,  .132414,  .109316,  .067036,
     $  .000000,  .000000,  .070223,  .115060,  .133733,  .147590,
     $  .133733,  .115060,  .070223,  .000000,  .000000,  .067036,
     $  .109316,  .132414,  .133733,  .132414,  .109316,  .067036,
     $  .000000,  .000000,  .036744,  .091025,  .109316,  .115060,
     $  .109316,  .091025,  .036744,  .000000,  .000000,  .036712,
     $  .036744,  .067035,  .070223,  .067035,  .036744,  .036712,
     $  .000000,  .000000,  .000000,  .000000,  .000000,  .000000,
     $  .000000,  .000000,  .000000,  .000000/
3C
      DATA TAB2/  .000000,  .000000,  .000000,  .000000,  .000000,
     $  .000000,  .000000,  .000000,  .000000,  .000000,  .648110,
     $  .770934,  .791956,  .784324,  .791956,  .770934,  .648110,
     $  .000000,  .000000,  .770993,  .933309,  .957243,  .961261,
     $  .957243,  .933309,  .770934,  .000000,  .000000,  .791956,
     $  .957243,  .933335,  .931133,  .933335,  .957242,  .791956,
     $  .000000,  .000000,  .784324,  .961261,  .931133,  .995494,
     $  .931133,  .961261,  .784324,  .000000,  .000000,  .791956,
     $  .957242,  .933335,  .931133,  .933335,  .957242,  .791956,
     $  .000000,  .000000,  .770993,  .933309,  .957242,  .961261,
     $  .957243,  .933309,  .770993,  .000000,  .000000,  .648110,
     $  .770934,  .791956,  .784324,  .791956,  .770993,  .648110,
     $  .000000,  .000000,  .000000,  .000000,  .000000,  .000000,
     $  .000000,  .000000,  .000000,  .000000/
3C
      DATA TAB3/  .000000,  .000000,  .000000,  .000000,  .000000,
     $  .000000,  .000000,  .000000,  .000000,  .000000,  .034389,
     $  .036745,  .036744,  .036744,  .036744,  .036745,  .034389,
```

```
3     $  .000000,  .000000,  .052605,  .083611,  .099831,  .104916,
3     $  .099831,  .083611,  .052605,  .000000,  .000000,  .061771,
3     $  .083831,  .120335,  .126773,  .120335,  .099831,  .061771,
3     $  .000000,  .000000,  .084583,  .104916,  .126773,  .133669,
3     $  .126773,  .104916,  .084583,  .000000,  .000000,  .061771,
3     $  .099831,  .120335,  .126773,  .120335,  .099831,  .061771,
3     $  .000000,  .000000,  .052604,  .083611,  .099830,  .104916,
3     $  .099830,  .083611,  .052604,  .000000,  .000000,  .034389,
3     $  .052604,  .061770,  .084583,  .061770,  .052604,  .034389,
3     $  .000000,  .000000,  .000000,  .000000,  .000000,  .000000,
3     $  .000000,  .000000,  .000000,  .000000/
3C
3      DATA TAB4/  .000000,  .000000,  .000000,  .000000,  .000000,
3     $  .000000,  .000000,  .000000,  .000000,  .000000,  .034316,
3     $  .052485,  .061586,  .084333,  .061586,  .052485,  .034316,
3     $  .000000,  .000000,  .052486,  .083345,  .099507,  .104531,
3     $  .099507,  .083345,  .052485,  .000000,  .000000,  .061586,
3     $  .099507,  .119864,  .126259,  .119864,  .099507,  .061586,
3     $  .000000,  .000000,  .084332,  .104531,  .126259,  .133110,
3     $  .126259,  .104531,  .084332,  .000000,  .000000,  .061586,
3     $  .099507,  .119864,  .126259,  .119864,  .099507,  .061586,
3     $  .000000,  .000000,  .052485,  .083345,  .099507,  .104531,
3     $  .099507,  .083345,  .052485,  .000000,  .000000,  .034315,
3     $  .052485,  .061586,  .084332,  .061586,  .052485,  .034315,
3     $  .000000,  .000000,  .000000,  .000000,  .000000,  .000000,
3     $  .000000,  .000000,  .000000,  .000000/
3C
3C    INTERPOLATE NONLINEAR SOLUTION BY QUADRATICS
3C
3     CALL QUADRD(X,Y,TAB&E,GRID,GRID,NGRID,NGRID,NGRDD,NGRDD,DERUSL)
3C
3     G = DERUSL(G)
3C
3     U = -(&A**2)*(1.-G)**(&B-1)*EXP(&C*&D*G/(1.+&C*G))
3C
3     RETURN
3     END
```

```
'EOR
**************
* MACRO  45 *
**************
*         2000001202000
1         TWO DIMENSIONS $ HOMOGENEOUS
1         UXX$ + UYY$ - (&A*R(X,Y))U$ = 0.0
2         DIRICHLET
2         X=0. , U=TRUE(X,Y)
2         X=1. , U=TRUE(X,Y)
2         Y=0. , U=TRUE(X,Y)
2         Y=1. , U=TRUE(X,Y)
3     FUNCTION TRUE(X,Y)
3C
3C    ********************************************************
3C    *                                                      *
3C    *                 MACRO 45 PARAMETERS                  *
3C    *                                                      *
3C    ********************************************************
3C    *                                                      *
3C    *                   A   I  B  I  C                     *
3C    *                 ------I-----I-----                   *
3C    *                     2 I  1  I  1                     *
3C    *                       I     I                        *
3C    *                  1000 I  1  I  2                     *
3C    *                       I     I                        *
3C    *                     2 I  2  I  3                     *
3C    *                                                      *
3C    ********************************************************
3C
3     REAL DERUSL(G), GRID(20), TABLE(20,20),
3    $     T1B1(100), T1B2(100), T1B3(100), T1B4(100),
3    $     T2B1(100), T2B2(100), T2B3(100), T2B4(100),
3    $     T3B1(100), T3B2(100), T3B3(100), T3B4(100)
3      EQUIVALENCE (TABLE(1, 1) , T&CB1(1)),
3    $             (TABLE(1, 6) , T&CB2(1)),
3    $             (TABLE(1,11) , T&CB3(1)),
3    $             (TABLE(1,16) , T&CB4(1))
```

```
3      DATA NGRID, NGRDD, GRID /20, 20,  0.000000, 0.0526316,
3     $0.1052632, 0.1578947, 0.2105263, 0.2631579, 0.3157895,
3     $0.3684211, 0.4210526, 0.4736842, 0.5263158, 0.5789474,
3     $0.6315789, 0.6842105, 0.7368421, 0.7894737, 0.8421053,
3     $0.8947368, 0.9473684, 1.0000000/
3C
3C     APPROXIMATE SOLUTION OF LINEARIZED PROBLEM USING
3C     HODIE-ACF (METHOD=4, IORDER=41, 20 X 20 GRID)
3C
3      DATA T1B1/  .726132,  .712680,  .701080,  .691075,  .682910,
3     $  .676141,  .670804,  .666917,  .664211,  .662966,  .662966,
3     $  .664211,  .666917,  .670805,  .676142,  .682910,  .691075,
3     $  .701080,  .712680,  .725132,  .712679,  .698560,  .686375,
3     $  .675985,  .667311,  .660220,  .654633,  .650495,  .647745,
3     $  .646386,  .646386,  .647745,  .650496,  .654633,  .660220,
3     $  .667312,  .675985,  .686376,  .698560,  .712680,  .701079,
3     $  .686375,  .673701,  .662897,  .653849,  .646454,  .640630,
3     $  .636314,  .633459,  .632039,  .632039,  .633459,  .636314,
3     $  .640631,  .646455,  .652849,  .662897,  .673701,  .686375,
3     $  .701080,  .691074,  .675984,  .662897,  .651725,  .642360,
3     $  .634703,  .628672,  .624202,  .621247,  .619777,  .619777,
3     $  .621247,  .624202,  .628672,  .634703,  .642361,  .651726,
3     $  .662837,  .675984,  .691074,  .682903,  .667311,  .653849,
3     $  .642360,  .632726,  .624845,  .618637,  .614036,  .610995,
3     $  .609482,  .609482,  .610995,  .614036,  .618637,  .624846,
3     $  .632726,  .642360,  .653849,  .667311,  .682908/
3C
3      DATA T1B2/  .676140,  .660219,  .646454,  .634703,  .624845,
3     $  .616781,  .610426,  .605716,  .602602,  .601053,  .601053,
3     $  .602602,  .605716,  .610426,  .616781,  .624845,  .634703,
3     $  .646454,  .660219,  .676140,  .670803,  .654632,  .640630,
3     $  .628671,  .618637,  .610426,  .603954,  .599157,  .595986,
3     $  .594408,  .594408,  .595986,  .599157,  .603954,  .610426,
3     $  .618637,  .628671,  .640630,  .654632,  .670804,  .666916,
3     $  .650495,  .636314,  .624202,  .614036,  .605716,  .599157,
3     $  .594295,  .591080,  .589481,  .589481,  .591080,  .594295,
3     $  .599157,  .605715,  .614036,  .624202,  .636314,  .650495,
3     $  .666916,  .654211,  .647745,  .633459,  .621247,  .610995,
3     $  .602602,  .595986,  .591080,  .587837,  .586223,  .586223,
3     $  .587837,  .591080,  .595986,  .602602,  .610995,  .621247,
3     $  .633458,  .647745,  .654210,  .662867,  .646386,  .632039,
3     $  .619777,  .609482,  .601053,  .594408,  .589481,  .586223,
3     $  .584603,  .584603,  .586223,  .589481,  .594408,  .601053,
3     $  .609482,  .619777,  .632039,  .646386,  .662966/
3C
3      DATA T1B3/  .662968,  .646387,  .632039,  .619777,  .609482,
3     $  .601053,  .594408,  .589481,  .586223,  .584603,  .584603,
3     $  .586223,  .589481,  .594408,  .601053,  .609482,  .619777,
3     $  .632039,  .646386,  .662966,  .654212,  .647746,  .633459,
3     $  .621247,  .610995,  .602602,  .595986,  .591080,  .587837,
3     $  .586223,  .586223,  .587837,  .591080,  .595985,  .602602,
3     $  .610995,  .621247,  .633459,  .647745,  .654211,  .666918,
3     $  .650496,  .636314,  .624202,  .614036,  .605716,  .599157,
3     $  .594295,  .591080,  .589481,  .589481,  .591080,  .594295,
3     $  .599157,  .605715,  .614036,  .624202,  .636314,  .650495,
3     $  .666917,  .670805,  .654633,  .640631,  .628672,  .618637,
3     $  .610426,  .603954,  .599157,  .595985,  .594408,  .594408,
3     $  .595985,  .599157,  .603954,  .610425,  .618637,  .628672,
3     $  .640630,  .654633,  .670804,  .676143,  .660220,  .646455,
3     $  .634703,  .624845,  .616780,  .610425,  .605715,  .602602,
3     $  .601053,  .601053,  .602602,  .605715,  .610425,  .616780,
3     $  .624845,  .634703,  .646454,  .660220,  .676141/
3C
3      DATA T1B4/  .682910,  .667312,  .653849,  .642360,  .632726,
3     $  .624845,  .618637,  .614036,  .610995,  .609482,  .609482,
3     $  .610994,  .614036,  .618637,  .624845,  .632726,  .642360,
3     $  .653849,  .667311,  .682910,  .691075,  .675934,  .662897,
3     $  .651725,  .642360,  .634703,  .628671,  .624202,  .621247,
3     $  .619777,  .619777,  .621247,  .624201,  .628671,  .634703,
3     $  .642360,  .651725,  .662897,  .675935,  .691075,  .701079,
3     $  .686374,  .673701,  .662895,  .653848,  .646454,  .640630,
3     $  .636314,  .633458,  .632039,  .632039,  .633458,  .636313,
3     $  .640630,  .646454,  .653848,  .662897,  .673701,  .686375,
3     $  .701080,  .712678,  .725359,  .712374,  .675934,  .667310,
3     $  .660219,  .654632,  .650495,  .647745,  .646386,  .646386,
3     $  .647744,  .650495,  .654632,  .660219,  .667310,  .675934,
```

```
3     $  .688375,  .693560,  .712680,  .726129,  .712678,  .701078,
3     $  .691073,  .682008,  .676140,  .670803,  .665916,  .664210,
3     $  .662866,  .662866,  .664210,  .665916,  .670803,  .676140,
3     $  .682008,  .691074,  .701079,  .712679,  .726131/
3C
3      DATA T231/  .055352,  .048804,  .037356,  .031205,  .033785,
3     $  .033551,  .033579,  .033571,  .033566,  .033569,  .033569,
3     $  .033566,  .033571,  .033579,  .033551,  .033785,  .031205,
3     $  .037356,  .048804,  .055352,  .048804,  .014807,  .008223,
3     $  .006469,  .006373,  .006387,  .006385,  .006384,  .006384,
3     $  .006234,  .006384,  .006384,  .006384,  .006385,  .006387,
3     $  .006373,  .006469,  .008223,  .014807,  .048804,  .037356,
3     $  .008223,  .002597,  .001460,  .001251,  .001220,  .001215,
3     $  .001214,  .001214,  .001214,  .001214,  .001214,  .001214,
3     $  .001215,  .001220,  .001251,  .001460,  .002597,  .008223,
3     $  .037356,  .031205,  .006469,  .001460,  .000468,  .000275,
3     $  .000250,  .000232,  .000231,  .000231,  .000231,  .000231,
3     $  .000231,  .000231,  .000232,  .000239,  .000275,  .000468,
3     $  .001460,  .006469,  .031205,  .033785,  .006373,  .001251,
3     $  .000275,  .000088,  .000052,  .000045,  .000044,  .000044,
3     $  .000044,  .000044,  .000044,  .000044,  .000045,  .000052,
3     $  .000083,  .000275,  .001251,  .006373,  .033785/
3C
3      DATA T232/  .033551,  .006337,  .001220,  .000239,  .000052,
3     $  .000017,  .000010,  .000009,  .000008,  .000008,  .000008,
3     $  .000008,  .000008,  .000009,  .000010,  .000017,  .000052,
3     $  .000239,  .001220,  .006337,  .033551,  .033579,  .006385,
3     $  .001215,  .000232,  .000045,  .000010,  .000003,  .000002,
3     $  .000002,  .000002,  .000002,  .000002,  .000003,  .000010,
3     $  .000045,  .000232,  .001215,  .006385,  .033579,  .033571,
3     $  .006334,  .001214,  .000231,  .000044,  .000009,  .000002,
3     $  .000001,  .000000,  .000000,  .000000,  .000000,  .000001,
3     $  .000002,  .000009,  .000044,  .000231,  .001214,  .006384,
3     $  .033571,  .033566,  .006384,  .001214,  .000231,  .000044,
3     $  .000008,  .000002,  .000000,  .000000,  .000000,  .000000,
3     $  .000000,  .000000,  .000002,  .000008,  .000044,  .000231,
3     $  .001214,  .006384,  .033566,  .033569,  .006384,  .001214,
3     $  .000231,  .000044,  .000008,  .000002,  .000000,  .000000,
3     $  .000000,  .000000,  .000000,  .000000,  .000002,  .000008,
3     $  .000044,  .000231,  .001214,  .006384,  .033569/
3C
3      DATA T233/  .033569,  .006384,  .001214,  .000231,  .000044,
3     $  .000008,  .000002,  .000000,  .000000,  .000000,  .000000,
3     $  .000000,  .000000,  .000002,  .000008,  .000044,  .000231,
3     $  .001214,  .006384,  .033569,  .033566,  .006384,  .001214,
3     $  .000231,  .000044,  .000008,  .000002,  .000000,  .000000,
3     $  .000000,  .000000,  .000000,  .000000,  .000002,  .000008,
3     $  .000044,  .000231,  .001214,  .006384,  .033566,  .033571,
3     $  .006334,  .001214,  .000231,  .000044,  .000009,  .000002,
3     $  .000001,  .000000,  .000000,  .000000,  .000000,  .000001,
3     $  .000002,  .000009,  .000044,  .000231,  .001214,  .006384,
3     $  .033571,  .033579,  .006235,  .001215,  .000232,  .000045,
3     $  .000010,  .000003,  .000002,  .000002,  .000002,  .000002,
3     $  .000002,  .000002,  .000003,  .000010,  .000045,  .000232,
3     $  .001215,  .006385,  .033579,  .033551,  .006387,  .001220,
3     $  .000239,  .000052,  .000017,  .000010,  .000009,  .000008,
3     $  .000008,  .000008,  .000008,  .000009,  .000010,  .000017,
3     $  .000052,  .000239,  .001220,  .006387,  .033551/
3C
3      DATA T234/  .033785,  .006373,  .001251,  .000275,  .000088,
3     $  .000052,  .000045,  .000044,  .000044,  .000044,  .000044,
3     $  .000044,  .000044,  .000045,  .000052,  .000083,  .000275,
3     $  .001251,  .006373,  .033785,  .031205,  .006469,  .001460,
3     $  .000468,  .000275,  .000239,  .000232,  .000231,  .000231,
3     $  .000231,  .000231,  .000231,  .000232,  .000239,  .000275,
3     $  .000468,  .001460,  .006469,  .031205,  .037356,  .033566,
3     $  .008223,  .002597,  .001460,  .001251,  .001220,  .001215,
3     $  .001214,  .001214,  .001214,  .001214,  .001214,  .001214,
3     $  .001215,  .001220,  .001251,  .001460,  .002597,  .008223,
3     $  .037356,  .048804,  .014807,  .008223,  .006469,  .006373,
3     $  .006387,  .006385,  .006384,  .006384,  .006384,  .006384,
3     $  .006384,  .006384,  .006385,  .006387,  .006373,  .006469,
3     $  .008223,  .014807,  .048804,  .055352,  .048804,  .037356,
3     $  .031205,  .033785,  .033551,  .033579,  .033571,  .033566,
3     $  .033569,  .033569,  .033566,  .033571,  .033579,  .033551,
3     $  .033785,  .031205,  .037356,  .048804,  .055352/
```

```
3C
3       DATA T331/  .781015,  .771893,  .771111,  .754254,  .747914,
3     $  .742552,  .733533,  .733531,  .732113,  .722150,  .732490,
3     $  .738413,  .733530,  .738532,  .742532,  .747914,  .754255,
3     $  .762111,  .771502,  .781015,  .771201,  .760362,  .750446,
3     $  .742303,  .735545,  .730042,  .725722,  .722530,  .720411,
3     $  .719067,  .720033,  .720411,  .722530,  .725722,  .730042,
3     $  .735545,  .742303,  .750446,  .760362,  .771232,  .762110,
3     $  .750445,  .740453,  .731565,  .721043,  .719203,  .714698,
3     $  .711367,  .709163,  .708071,  .708215,  .709167,  .711367,
3     $  .714207,  .719203,  .724342,  .731565,  .740453,  .750445,
3     $  .762110,  .754253,  .742302,  .731685,  .723244,  .715944,
3     $  .709233,  .705331,  .701331,  .699915,  .698473,  .698473,
3     $  .699904,  .701831,  .705331,  .709938,  .715943,  .723244,
3     $  .731934,  .742302,  .754353,  .747913,  .735545,  .724942,
3     $  .715943,  .708432,  .702313,  .697507,  .693855,  .691610,
3     $  .690446,  .690445,  .691610,  .693654,  .697507,  .702312,
3     $  .708432,  .715943,  .724341,  .735544,  .747911/
3C
3       DATA T332/  .742651,  .730041,  .719202,  .709958,  .702312,
3     $  .696040,  .691123,  .687491,  .685090,  .683897,  .683897,
3     $  .685093,  .687490,  .691123,  .696043,  .702312,  .709997,
3     $  .719201,  .730040,  .742649,  .733532,  .725721,  .714697,
3     $  .705331,  .697507,  .691123,  .686117,  .682411,  .679965,
3     $  .678750,  .678749,  .679965,  .682411,  .686116,  .691128,
3     $  .697506,  .705330,  .714993,  .725720,  .738530,  .735530,
3     $  .722523,  .711366,  .701831,  .693654,  .687490,  .682411,
3     $  .678654,  .676174,  .674942,  .674942,  .676174,  .678654,
3     $  .682410,  .687490,  .693353,  .701830,  .711365,  .722527,
3     $  .735523,  .733442,  .720410,  .709167,  .699604,  .691610,
3     $  .685090,  .679965,  .676174,  .673672,  .672428,  .672428,
3     $  .673672,  .676174,  .679934,  .685089,  .691609,  .699603,
3     $  .709166,  .720409,  .733440,  .732423,  .719366,  .708074,
3     $  .698472,  .690445,  .683896,  .673749,  .674941,  .672428,
3     $  .671179,  .671179,  .672428,  .674941,  .678749,  .683896,
3     $  .690444,  .698471,  .708073,  .719364,  .732437/
3C
3       DATA T333/  .732489,  .719365,  .708074,  .698472,  .690444,
3     $  .683896,  .678749,  .674941,  .672428,  .671179,  .671178,
3     $  .672423,  .674941,  .678743,  .683896,  .690444,  .698471,
3     $  .708073,  .719334,  .732487,  .733441,  .720409,  .709166,
3     $  .699603,  .691609,  .685089,  .679964,  .676173,  .673671,
3     $  .672427,  .672427,  .673671,  .676173,  .679964,  .685088,
3     $  .691603,  .699602,  .709165,  .720403,  .733439,  .735528,
3     $  .722527,  .711365,  .701873,  .693353,  .687439,  .682409,
3     $  .678653,  .676173,  .674341,  .674341,  .676173,  .678652,
3     $  .682403,  .687489,  .693352,  .701873,  .711364,  .722526,
3     $  .735527,  .738523,  .725719,  .714335,  .705329,  .697505,
3     $  .691126,  .686115,  .682409,  .678333,  .678743,  .678748,
3     $  .679963,  .682409,  .686115,  .691126,  .697504,  .705328,
3     $  .714334,  .725718,  .738523,  .742643,  .730039,  .719200,
3     $  .709326,  .702310,  .696046,  .691126,  .687463,  .685088,
3     $  .683835,  .683835,  .685033,  .687423,  .691126,  .696046,
3     $  .702310,  .709335,  .719133,  .730033,  .742647/
3C
3       DATA T334/  .747309,  .735541,  .724333,  .715940,  .708429,
3     $  .702310,  .697504,  .693352,  .691603,  .690443,  .690443,
3     $  .691603,  .693352,  .697504,  .702310,  .703429,  .715940,
3     $  .724330,  .735541,  .747903,  .754250,  .742299,  .731991,
3     $  .723240,  .715940,  .709335,  .705323,  .701378,  .699601,
3     $  .693470,  .693470,  .699601,  .701873,  .705323,  .709995,
3     $  .715940,  .723241,  .731031,  .742299,  .754250,  .762106,
3     $  .750441,  .740455,  .731831,  .724338,  .719198,  .714693,
3     $  .711363,  .709164,  .708071,  .708072,  .709134,  .711363,
3     $  .714693,  .719199,  .724928,  .731991,  .740455,  .750442,
3     $  .762107,  .771257,  .760047,  .750441,  .742293,  .735540,
3     $  .730037,  .725717,  .722525,  .720403,  .719332,  .719362,
3     $  .720407,  .722525,  .725717,  .730037,  .735541,  .742298,
3     $  .750441,  .760043,  .771253,  .781909,  .771253,  .762105,
3     $  .754240,  .747303,  .742543,  .738527,  .735525,  .733437,
3     $  .732435,  .732405,  .733133,  .735335,  .735523,  .742646,
3     $  .747303,  .754243,  .762103,  .771257,  .781911/
3C
3C      INTERPOLATE NONLINEAR SOLUTION BY QUADRATICS
3C
3       CALL QUADROOK(X,XXOLE,GRID,GRID,NGRID,NGRID,NGRDD,NGRDD,DERVSL)
```

```
3C
3     TRUE = DERVSL(6)
3C
3     RETURN
3     END
3     FUNCTION R(X,Y)
3C
3     REAL DERVSL(6), GRID(9), TAB3(9,9)
3     DATA NGRID, NGRDD, GRID /9, 9, 0., 0.125, 0.250,
3    $0.375, 0.500, 0.625, 0.750, 0.875, 1.00/
3C
3C    APPROXIMATE SOLUTION OF NONLINEAR PROBLEM FOR NONLINEAR
3C    COLLOCATION
3C
3     DATA TAB3/  .781915,  .759056,  .743903,  .735237,  .732417,
3    $  .735235,  .743903,  .759066,  .781915,  .759065,  .733775,
3    $  .716957,  .707336,  .704204,  .707335,  .716957,  .733776,
3    $  .759065,  .743902,  .716956,  .698974,  .688669,  .685312,
3    $  .688668,  .698973,  .716955,  .743900,  .735236,  .707335,
3    $  .688658,  .677956,  .674465,  .677955,  .688666,  .707333,
3    $  .735234,  .732416,  .704204,  .685311,  .674464,  .670928,
3    $  .674483,  .685309,  .704201,  .732414,  .735234,  .707333,
3    $  .688656,  .677954,  .674483,  .677953,  .688665,  .707332,
3    $  .735233,  .743899,  .716953,  .698970,  .688658,  .685309,
3    $  .688665,  .698970,  .716952,  .743898,  .759061,  .733772,
3    $  .716952,  .707331,  .704200,  .707332,  .716952,  .733771,
3    $  .759062,  .781909,  .759060,  .743897,  .735231,  .732412,
3    $  .735232,  .743897,  .759061,  .781911/
3C
3     IF (&B .EQ. 2) GO TO 10
3     R = 1.0
3     RETURN
3C
3C    INTERPOLATE NONLINEAR SOLUTION BY QUADRATICS
3C
3  10 CALL QUADRD(X,Y,TAB3,GRID,GRID,NGRID,NGRID,NGRDD,NGRDD,DERVSL)
3C
3     R = DERVSL(6)
3C
3     RETURN
3     END
```

```
'EOR
*************
* MACRO  46 *
*************
*         2000220202000
1         TWO DIMENSIONS $ CONSTANT COEFFICIENTS $ HOMOGENEOUS
1         UXX$ + UYY$ - &BUY$ = 0.
2         DIRICHLET
2         X=0. , U= 0.
2         X=&A , U= 0.
2         Y=0. , U=-1.
2         Y=1. , U= 1.
3     FUNCTION TRUE(X,Y)
3C
3C    ***********************************************************
3C    *                                                         *
3C    *                 MACRO 46 PARAMETERS                     *
3C    *                                                         *
3C    ***********************************************************
3C    *                                                         *
3C    *                   A  I   B  I  C                        *
3C    *                  ----I------I-----                      *
3C    *                   1  I   2  I  1                        *
3C    *                      I      I                           *
3C    *                   4  I   2  I  2                        *
3C    *                      I      I                           *
3C    *                   4  I  10  I  3                        *
3C    *                      I      I                           *
3C    *                   8  I   2  I  4                        *
3C    *                                                         *
3C    ***********************************************************
3C
3     REAL DERVSL(6), TABLE(20,20), GRID1(20),
3    $     GRID2(20), GRID3(20), GRID4(20),
```

```
3     $      T1B1(100), T1B2(100), T1B3(100), T1B4(100),
3     $      T2B1(100), T2B2(100), T2B3(100), T2B4(100),
3     $      T3B1(100), T3B2(100), T3B3(100), T3B4(100),
3     $      T4B1(100), T4B2(100), T4B3(100), T4B4(100)
3      EQUIVALENCE (TABLE(1, 1) , T&CB1(1)),
3     $            (TABLE(1, 6) , T&CB2(1)),
3     $            (TABLE(1,11) , T&CB3(1)),
3     $            (TABLE(1,16) , T&CB4(1))
3      DATA NGRID, NGRDD/20, 20/
3      DATA GRID1/0.0000000, 0.0526316, 0.1052632, 0.1578947,
3     $0.2105263, 0.2631579, 0.3157895, 0.3684211, 0.4210526,
3     $0.4736842, 0.5263158, 0.5789474, 0.6315789, 0.6842105,
3     $0.7368421, 0.7894737, 0.8421053, 0.8947368, 0.9473684,
3     $1.0000000/
3      DATA GRID2/0.0000000, 0.2105263, 0.4210526, 0.6315789,
3     $0.8421053, 1.0526316, 1.2631579, 1.4736842, 1.6842105,
3     $1.8947368, 2.1052632, 2.3157895, 2.5263158, 2.7368421,
3     $2.9473684, 3.1578947, 3.3684211, 3.5789474, 3.7894737,
3     $4.0000000/
3      DATA GRID3/0.0000000, 0.2105263, 0.4210526, 0.6315789,
3     $0.8421053, 1.0526316, 1.2631579, 1.4736842, 1.6842105,
3     $1.8947368, 2.1052632, 2.3157895, 2.5263158, 2.7368421,
3     $2.9473684, 3.1578947, 3.3684211, 3.5789474, 3.7894737,
3     $4.0000000/
3      DATA GRID4/0.0000000, 0.4210526, 0.8421053, 1.2631579,
3     $1.6842105, 2.1052632, 2.5263158, 2.9473684, 3.3684211,
3     $3.7894737, 4.2105263, 4.6315789, 5.0526316, 5.4736842,
3     $5.8947368, 6.3157895, 6.7368421, 7.1578947, 7.5789474,
3     $8.0000000/
3C
3C     APPROXIMATE SOLUTION OF PROBLEM USING
3C     P3-C1 COLLOCATION (8 X 8 GRID)
3C
3      DATA T1B1/-1.000000,-1.000000,-1.000000,-1.000000,-1.000000,
3     $-1.000000,-1.000000,-1.000000,-1.000000,-1.000000,-1.000000,
3     $-1.000000,-1.000000,-1.000000,-1.000000,-1.000000,-1.000000,
3     $-1.000000,-1.000000,-1.000000,  .031332, -.205316, -.634229,
3     $ -.817443, -.857488, -.894001, -.909298, -.919245, -.926200,
3     $ -.928640, -.928751, -.926530, -.921708, -.911556, -.898806,
3     $ -.875902, -.827951, -.792383, -.619858,  .031332, -.042140,
3     $ -.219279, -.513384, -.673778, -.741340, -.789473, -.817825,
3     $ -.836165, -.847318, -.852362, -.852400, -.847433, -.837020,
3     $ -.818609, -.791142, -.747734, -.677427, -.568299, -.363217,
3     $ -.042140, -.047770, -.227276, -.415552, -.547625, -.630577,
3     $ -.687743, -.725177, -.750246, -.765570, -.772650, -.772702,
3     $ -.765706, -.751106, -.725896, -.688705, -.632823, -.548641,
3     $ -.425126, -.250824, -.047770,  .006366, -.152467, -.320495,
3     $ -.445435, -.530434, -.593233, -.635471, -.664645, -.683032,
3     $ -.691458, -.691540, -.683244, -.665984, -.636590, -.594731,
3     $ -.533931, -.447016, -.335403, -.189134,  .006366/
3C
3      DATA T1B2/ -.008657, -.135812, -.262867, -.367015, -.446535,
3     $ -.507305, -.551224, -.581744, -.600866, -.610109, -.610123,
3     $ -.600900, -.581958, -.551403, -.507545, -.447094, -.367268,
3     $ -.265253, -.141679, -.008657, -.001713, -.112130, -.213651,
3     $ -.302230, -.374162, -.429104, -.471392, -.501214, -.519955,
3     $ -.529380, -.529314, -.519998, -.501114, -.471112, -.428774,
3     $ -.372592, -.301277, -.212279, -.111526, -.001713,  .000386,
3     $ -.089061, -.171761, -.245781, -.307823, -.356682, -.395073,
3     $ -.422671, -.440317, -.449200, -.449148, -.440351, -.422593,
3     $ -.394853, -.356424, -.306595, -.245036, -.170687, -.088588,
3     $  .000386, -.000909, -.069776, -.135734, -.195175, -.246134,
3     $ -.288236, -.321251, -.345454, -.361272, -.369111, -.369110,
3     $ -.361272, -.345452, -.321246, -.288229, -.246103, -.195156,
3     $ -.135706, -.069764, -.000909, -.000015, -.055003, -.103510,
3     $ -.149636, -.190299, -.222356, -.249766, -.269504, -.282002,
3     $ -.288832, -.288693, -.281920, -.268605, -.248813, -.221354,
3     $ -.187692, -.148376, -.100697, -.051419, -.000015/
3C
3      DATA T1B3/ -.000008, -.037091, -.070953, -.103191, -.132083,
3     $ -.155868, -.176071, -.191055, -.200851, -.206051, -.205973,
3     $ -.200813, -.190640, -.175631, -.155406, -.130880, -.102610,
3     $ -.069654, -.035437, -.000008, -.000052, -.019880, -.037915,
3     $ -.055845, -.072664, -.086967, -.099741, -.109479, -.115981,
3     $ -.119490, -.119438, -.115931, -.109087, -.099374, -.086553,
3     $ -.071702, -.055412, -.038898, -.018570, -.000052,  .000004,
```

```
3     $ -.003237, -.002357, -.005676, -.010176, -.013191, -.018690,
3     $ -.022750, -.025201, -.027278, -.027119, -.025143, -.021619,
3     $ -.017505, -.011956, -.007304, -.004382,  .000184,  .000626,
3     $  .000007, -.000005,  .020237,  .033102,  .053523,  .063214,
3     $  .063875,  .072410,  .070533,  .070905,  .073785,  .073824,
3     $  .070012,  .070373,  .070382,  .063332,  .063926,  .053844,
3     $  .065365,  .021193, -.000015, -.000002,  .043677,  .088153,
3     $  .122155,  .143330,  .154155,  .174203,  .180593,  .184310,
3     $  .153370,  .156716,  .164453,  .181530,  .175081,  .165306,
3     $  .143805,  .123393,  .031639,  .048563, -.000002/
3C
3      DATA T1B1/  .000000,  .077702,  .152670,  .208663,  .247505,
3     $  .275850,  .292390,  .302750,  .308873,  .311346,  .311390,
3     $  .309025,  .303747,  .293226,  .277171,  .250465,  .210048,
3     $  .153400,  .092355,  .000000, -.000001,  .138542,  .244360,
3     $  .324203,  .377583,  .410414,  .431180,  .443662,  .450375,
3     $  .453423,  .453502,  .450337,  .443745,  .431250,  .410515,
3     $  .377831,  .324114,  .244573,  .138975, -.000001,  .000000,
3     $  .102335,  .272735,  .479230,  .534312,  .572794,  .593440,
3     $  .603291,  .611330,  .614897,  .614676,  .611773,  .605705,
3     $  .593524,  .574053,  .503910,  .481864,  .384839,  .206024,
3     $  .000000,  .000000,  .354539,  .600069,  .692728,  .736814,
3     $  .763311,  .782081,  .790041,  .794434,  .796406,  .796274,
3     $  .794529,  .790283,  .782132,  .768066,  .739573,  .694278,
3     $  .617330,  .378554,  .000000,  .000000, 1.031332,  .957860,
3     $  .952231, 1.006366,  .831341,  .998282, 1.000391,  .999039,
3     $  .998977,  .998977,  .999039, 1.000391,  .998282,  .991341,
3     $ 1.006366,  .952230,  .957860, 1.031332,  .000000/
3C
3      DATA T2B1/-1.000000,-1.000000,-1.000000,-1.000000,-1.000000,
3     $-1.000000,-1.000000,-1.000000,-1.000000,-1.000000,-1.000000,
3     $-1.000000,-1.000000,-1.000000,-1.000000,-1.000000,-1.000000,
3     $-1.000000,-1.000000,-1.000000,-1.000000,  .031332, -.337383, -.743785,
3     $ -.913881, -.935099, -.955727, -.963381, -.964623, -.964870,
3     $ -.965591, -.965818, -.965444, -.966943, -.964632, -.965433,
3     $ -.973335, -.935573,-1.024956,-1.053698,  .031332, -.042140,
3     $ -.533009, -.820302, -.833901, -.907831, -.920828, -.924419,
3     $ -.925843, -.926183, -.926869, -.926601, -.926387, -.926451,
3     $ -.924354, -.923351, -.921108, -.895691, -.917931, -.831729,
3     $ -.042140, -.047770, -.662054, -.820058, -.847692, -.869017,
3     $ -.877901, -.881389, -.882810, -.883104, -.884071, -.883668,
3     $ -.883347, -.883194, -.881111, -.878338, -.870970, -.848504,
3     $ -.827376, -.677138, -.047770,  .006366, -.553459, -.742226,
3     $ -.791510, -.816764, -.828036, -.833113, -.834958, -.835207,
3     $ -.836699, -.836071, -.835585, -.835566, -.832664, -.829495,
3     $ -.819306, -.782775, -.753521, -.576948,  .006366/
3C
3      DATA T2B2/ -.003557, -.475263, -.670619, -.733207, -.761222,
3     $ -.773174, -.778339, -.781104, -.782017, -.782625, -.782525,
3     $ -.782077, -.781200, -.778537, -.773707, -.761709, -.733410,
3     $ -.672442, -.479021, -.003657, -.001713, -.417859, -.601276,
3     $ -.682284, -.699453, -.712347, -.719571, -.722325, -.722988,
3     $ -.724377, -.723393, -.723272, -.722708, -.719149, -.713804,
3     $ -.700511, -.683502, -.593330, -.403151, -.001713,  .000366,
3     $ -.510512, -.525281, -.528374, -.531821, -.648230, -.653400,
3     $ -.656841, -.657452, -.658720, -.658345, -.657674, -.656841,
3     $ -.653070, -.646000, -.622727, -.593534, -.522977, -.339572,
3     $  .000606, -.000909, -.279552, -.445959, -.523293, -.557765,
3     $ -.572544, -.579732, -.582272, -.584577, -.585328, -.585318,
3     $ -.584382, -.582280, -.579754, -.572651, -.557788, -.523298,
3     $ -.446000, -.279293, -.000909, -.000015, -.236101, -.372847,
3     $ -.442412, -.473725, -.491462, -.499207, -.502775, -.503925,
3     $ -.503184, -.504352, -.504105, -.502988, -.493892, -.491874,
3     $ -.479310, -.442191, -.339005, -.224010, -.000015/
3C
3      DATA T2B3/ -.000003, -.174330, -.333796, -.354438, -.386991,
3     $ -.401372, -.408212, -.412853, -.411247, -.415195, -.415051,
3     $ -.414221, -.412006, -.408066, -.401353, -.337034, -.354336,
3     $ -.333135, -.183780, -.000008, -.000052, -.115435, -.203240,
3     $ -.272010, -.303004, -.312453, -.306542, -.313150, -.314670,
3     $ -.315170, -.315531, -.314571, -.313133, -.306525, -.302397,
3     $ -.283002, -.253703, -.201257, -.111454, -.000052,  .000004,
3     $ -.081010, -.118996, -.154302, -.130712, -.192786, -.199325,
3     $ -.203206, -.204193, -.204700, -.204782, -.204139, -.202671,
3     $ -.199275, -.192314, -.170337, -.154332, -.107305, -.049554,
3     $  .000004, -.000006,  .016155, -.004438, -.006303, -.060347,
```

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3      $ -.071134, -.076930, -.080023, -.081035, -.081665, -.081963,
3      $ -.081365, -.030014, -.076667, [illegible] -.060127, -.039669,
       $  .006190,  .015553, -.000005, -.000002,  .036753,  .103147,
3      $  .086410,  .071635,  .063513,  .053120,  .056459,  .054982,
3      $  .055015,  .054713,  .055162,  .053707,  .056860,  .064149,
3      $  .072827,  .086860,  .109354,  .101000, -.000002/
3
3       DATA T234/  .000000,  .135035,  .232268,  .226260,  .218343,
3      $  .212836,  .209716,  .207645,  .206086,  .206549,  .206230,
3      $  .206576,  .207907,  .209142,  .213867,  .213600,  .226734,
3      $  .239342,  .201143,  .000000, -.000001,  .325205,  .384356,
3      $  .381560,  .382338,  .378775,  .376553,  .375239,  .374585,
3      $  .374347,  .374320,  .374601,  .375221,  .376535,  .378831,
3      $  .362444,  .331600,  .384350,  .328554, -.000001,  .000000,
3      $  .447745,  .538473,  .551925,  .562825,  .562458,  .563397,
3      $  .562762,  .561406,  .562354,  .562046,  .561944,  .563510,
3      $  .562623,  .564325,  .565423,  .553316,  .558360,  .493554,
3      $  .000000,  .000000,  .688631,  .735743,  .742208,  .769425,
3      $  .766365,  .769300,  .769354,  .768229,  .770034,  .769489,
3      $  .769152,  .770303,  .768533,  .767485,  .771525,  .743000,
3      $  .747631,  .716116,  .000000,  .000000, 1.031332,  .957860,
3      $  .952230, 1.006356,  .991341,  .998282, 1.000391,  .999039,
3      $  .999977,  .999977,  .999039, 1.000391,  .998282,  .991341,
3      $ 1.006356,  .952230,  .957860, 1.031332,  .000000/
3C
3       DATA T3B1/-1.000000,-1.000000,-1.000000,-1.000000,-1.000000,
3      $-1.000000,-1.000000,-1.000000,-1.000000,-1.000000,-1.000000,
3      $-1.000000,-1.000000,-1.000000,-1.000000,-1.000000,-1.000000,
3      $-1.000000,-1.000000,-1.000000,  .031332, -.391353, -.787651,
3      $ -.952148, -.972313, -.992515, -.993377, -.999771, -.999732,
3      $-1.001583,-1.000718,-1.000396,-1.002265,-1.000166,-1.001937,
3      $-1.013562, -.976541,-1.068341,-1.156170,  .031332, -.042140,
3      $ -.733253, -.934475, -.973754, -.988436, -.997347, -.999244,
3      $ -.999649, -.999790,-1.000378,-1.000076,-1.000010,-1.000515,
3      $ -.999692,-1.000618,-1.002753, -.922258,-1.038831, -.998814,
3      $ -.042140, -.047770, -.397063, -.835266, -.984043, -.996921,
3      $ -.999381,-1.000133,-1.000146, -.999665,-1.000622,-1.000080,
3      $ -.999976,-1.000428, -.999562,-1.000217, -.997765, -.984089,
3      $-1.003428, -.886322, -.047770,  .006366, -.785534, -.970029,
3      $ -.981972, -.995063, -.996631,-1.000227,-1.000181, -.999340,
3      $-1.000876,-1.000032, -.999824,-1.000713, -.999338, -.999933,
3      $ -.996334, -.982043, -.922737, -.815523,  .006366/
3C
3       DATA T3B2/ -.008657, -.734549, -.951262, -.979600, -.992541,
3      $ -.997615, -.998527, -.998770, -.998758, -.999012, -.998877,
3      $ -.998836, -.998855, -.998385, -.997323, -.992751, -.979611,
3      $ -.953296, -.739347, -.008657, -.001713, -.695870, -.931239,
3      $ -.974706, -.990749, -.996110, -.998562, -.998715, -.997850,
3      $ -.999426, -.999584, -.999329, -.999219, -.997652, -.997354,
3      $ -.991864, -.974667, -.923379, -.683361, -.001713,  .000386,
3      $ -.643618, -.903353, -.967714, -.987968, -.993604, -.996573,
3      $ -.996971, -.996303, -.997574, -.996915, -.996683, -.997365,
3      $ -.996862, -.994877, -.988840, -.967684, -.901591, -.633833,
3      $  .000386, -.000903, -.590183, -.872571, -.958490, -.983681,
3      $ -.990511, -.992719, -.993539, -.993634, -.993747, -.993730,
3      $ -.993644, -.993549, -.992700, -.990526, -.983704, -.958489,
3      $ -.872526, -.383933, -.000909, -.000015, -.535299, -.845608,
3      $ -.946655, -.977233, -.985404, -.988575, -.990322, -.989379,
3      $ -.991131, -.990251, -.988305, -.990267, -.988562, -.986861,
3      $ -.979124, -.947003, -.843301, -.535343, -.000015/
3C
3       DATA T3B3/ -.000003, -.521629, -.813193, -.931706, -.968043,
3      $ -.977270, -.981166, -.982221, -.982009, -.982914, -.982485,
3      $ -.982252, -.982572, -.986639, -.977942, -.968339, -.931869,
3      $ -.818872, -.521027, -.001003, -.000052, -.491214, -.787378,
3      $ -.911476, -.953237, -.962569, -.968005, -.969483, -.969411,
3      $ -.970045, -.969775, -.969664, -.969639, -.967733, -.964274,
3      $ -.953727, -.911553, -.787203, -.499058, -.000052,  .000004,
3      $ -.454670, -.753357, -.883324, -.930332, -.942674, -.948234,
3      $ -.949724, -.949093, -.954727, -.949319, -.949549, -.950201,
3      $ -.947349, -.943971, -.931326, -.891065, -.753829, -.458226,
3      $  .000001, -.000005, -.421151, -.716659, -.842431, -.892722,
3      $ -.906375, -.911637, -.913355, -.913402, -.914024, -.913824,
3      $ -.915035, -.913471, -.901237, -.898882, -.833035, -.842488,
3      $ -.705091, -.415516, [illegible] -.000002, -.379534, -.644307,
3      $ -.779599, -.8329 3, [illegible]  .992135, -.951105, -.854061,
```

```
3     $ -.851333, -.854553, -.854278, -.854316, -.851713, -.846988,
3     $ -.832322, -.779473, -.642034, -.371237, -.000002/
3C
3      DATA T334/  .000000, -.310433, -.550726, -.331613, -.733384,
3     $ -.742211, -.753335, -.755373, -.755314, -.756325, -.756430,
3     $ -.750137, -.756196, -.750534, -.713746, -.703721, -.681488,
3     $ -.540112, -.201723,  .000000, -.000001, -.133793, -.394309,
3     $ -.516554, -.592503, -.576052, -.581763, -.583555, -.584012,
3     $ -.584220, -.534196, -.534031, -.523673, -.531726, -.576997,
3     $ -.522532, -.516513, -.334113, -.132059, -.000001,  .000000,
3     $ -.034324, -.155323, -.254455, -.283333, -.298573, -.300552,
3     $ -.302165, -.303472, -.301833, -.302806, -.302942, -.301533,
3     $ -.301413, -.293711, -.234507, -.252845, -.145402,  .011876,
3     $  .000000,  .000000,  .332035,  .247819,  .183916,  .183132,
3     $  .174393,  .174712,  .174340,  .173400,  .174536,  .173985,
3     $  .173718,  .174737,  .174192,  .175519,  .185461,  .189282,
3     $  .250071,  .359305,  .000000,  .000000, 1.031332,  .957860,
3     $  .952230, 1.006366,  .991341,  .938222, 1.000391,  .959039,
3     $  .999977,  .999977,  .993039, 1.000391,  .993232,  .991341,
3     $ 1.006366,  .952230,  .957860, 1.031332,  .000000/
3C
3      DATA T431/-1.000000,-1.000000,-1.000000,-1.000000,-1.000000,
3     $-1.000000,-1.000000,-1.000000,-1.000000,-1.000000,-1.000000,
3     $-1.000000,-1.000000,-1.000000,-1.000000,-1.000000,-1.000000,
3     $-1.000000,-1.000000,-1.000000,  .031332, -.383300, -.751218,
3     $ -.914846, -.933203, -.955910, -.965106, -.965929, -.964996,
3     $ -.968304, -.969702, -.969073, -.969213, -.965975, -.968311,
3     $ -.934153, -.941438,-1.062985,-1.172797,  .031332, -.042140,
3     $ -.745919, -.871901, -.899702, -.919758, -.923304, -.926552,
3     $ -.926933, -.926564, -.927720, -.927163, -.926940, -.928138,
3     $ -.926354, -.927762, -.935713, -.908953, -.980153,-1.017783,
3     $ -.042140, -.047770, -.879355, -.904387, -.870308, -.888256,
3     $ -.884009, -.885089, -.885004, -.883794, -.885323, -.884493,
3     $ -.834251, -.885423, -.884105, -.885050, -.888553, -.869857,
3     $ -.913185, -.900626, -.047770,  .006366, -.785481, -.847400,
3     $ -.834578, -.839394, -.839717, -.838284, -.837921, -.836201,
3     $ -.838543, -.837251, -.839923, -.838573, -.839752, -.838353,
3     $ -.840509, -.823891, -.851101, -.817824,  .006366/
3C
3      DATA T432/ -.008557, -.716569, -.794651, -.774029, -.784215,
3     $ -.783934, -.783679, -.783549, -.783265, -.783585, -.783378,
3     $ -.783331, -.783554, -.783434, -.784196, -.784315, -.773919,
3     $ -.799344, -.721744, -.008557, -.001713, -.657153, -.737640,
3     $ -.718329, -.727195, -.725574, -.726301, -.725786, -.724499,
3     $ -.726221, -.725239, -.725948, -.726228, -.725075, -.726630,
3     $ -.723149, -.717332, -.731700, -.538213, -.001713,  .000386,
3     $ -.571192, -.655170, -.655241, -.661281, -.660421, -.660721,
3     $ -.660201, -.659171, -.660496, -.659728, -.659600, -.660547,
3     $ -.650763, -.651169, -.660453, -.654084, -.630524, -.556373,
3     $  .000386, -.000909, -.475176, -.592982, -.585535, -.587074,
3     $ -.537637, -.585974, -.586553, -.586553, -.586509, -.586490,
3     $ -.586634, -.586692, -.586650, -.537706, -.587053, -.583506,
3     $ -.532373, -.474797, -.000909, -.000015, -.416653, -.507417,
3     $ -.506007, -.508496, -.507456, -.507432, -.506353, -.505942,
3     $ -.507022, -.506335, -.506289, -.507159, -.506702, -.508112,
3     $ -.507916, -.505027, -.500147, -.394151, -.000015/
3C
3      DATA T433/ -.000008, -.320672, -.412314, -.413051, -.418808,
3     $ -.417933, -.417433, -.418374, -.416337, -.416733, -.416493,
3     $ -.416502, -.417013, -.417073, -.418235, -.416554, -.417645,
3     $ -.408033, -.310236, -.000008, -.000052, -.229702, -.312095,
3     $ -.321332, -.316571, -.316531, -.317527, -.316986, -.316778,
3     $ -.319604, -.319633, -.316730, -.316993, -.317515, -.318509,
3     $ -.318410, -.220573, -.308237, -.221335, -.000052,  .000004,
3     $ -.150003, -.209374, -.212207, -.210190, -.203235, -.207107,
3     $ -.206134, -.206203, -.206132, -.206113, -.206215, -.206474,
3     $ -.207072, -.203213, -.203709, -.212331, -.200313, -.127103,
3     $  .000004, -.000005, -.083236, -.093017, -.093450, -.087715,
3     $ -.083573, -.083083, -.083512, -.083333, -.083227, -.083224,
3     $ -.093303, -.093310, -.094020, -.095551, -.037566, -.093382,
3     $ -.023014, -.023133, -.000005, -.000002,  .059327,  .042659,
3     $  .039153,  .043332,  .053159,  .053013,  .053340,  .053179,
3     $  .051141,  .053333,  .053523,  .053334,  .052331,  .051364,
3     $  .040312,  .053251,  .053003,  .094539, -.000002/
3C
3      DATA T434/  .000000,  .200034,  .102239,  .183132,  .199304,
```

```
3     $  .201593,  .204578,  .205342,  .204799,  .205165,  .205515,
3     $  .205167,  .205715,  .203359,  .202557,  .200838,  .186231,
3     $  .199215,  .227337,  .000000, -.000001,  .377693,  .358224,
3     $  .349150,  .358398,  .359445,  .372052,  .373215,  .373255,
3     $  .373505,  .373550,  .373286,  .373246,  .372002,  .369526,
3     $  .358935,  .349153,  .359143,  .379935, -.000001,  .000000,
3     $  .510527,  .521359,  .529337,  .555947,  .555538,  .561830,
3     $  .562639,  .560416,  .564150,  .552308,  .561470,  .563803,
3     $  .559904,  .558547,  .560709,  .520083,  .545407,  .564037,
3     $  .000000,  .000000,  .744265,  .727279,  .729842,  .768632,
3     $  .762253,  .768695,  .770050,  .768224,  .770819,  .769714,
3     $  .768857,  .770743,  .767540,  .764029,  .770889,  .730290,
3     $  .741703,  .776371,  .000000,  .000000, 1.031332,  .957860,
3     $  .952230, 1.006356,  .931341,  .998282, 1.000391,  .999039,
3     $  .999977,  .999977,  .999039, 1.000391,  .998282,  .991341,
3     $ 1.006356,  .952230,  .957850, 1.031332,  .000000/
3C
3C
3C    INTERPOLATE NUMERICAL SOLUTION BY QUADRATICS
3C
3     CALL QUADRD(X,Y,TABLE,GRID&C,GRID1,NGRID,NGRID,NGRDD,NGRDD,
3    $            DERVSL)
3C
3     TRUE = DERVSL(6)
3C
3     RETURN
3     END
```

```
'EOR
*************
* MACRO  47 *
*************
*         2020021002000
1         TWO DIMENSIONS  $  CONSTANT COEFFICIENTS  $  POISSON
1         UXX$ + UYY$ = F(X,Y)
2         DIRICHLET
2         X=0. , U=TRUE(X,Y)
2         X=1. , U=TRUE(X,Y)
2         Y=0. , U=TRUE(X,Y)
2         Y=1. , U=TRUE(X,Y)
3     FUNCTION TRUE(X,Y)
3     TRUE = (X*Y)**(.5*(&A))
3     RETURN
3     END
3     FUNCTION F(X,Y)
3     IF ( X.EQ.0. .OR. Y.EQ.0. ) GO TO 10
3     F = (.5*(&A))*(.5*(&A)-1.)*(X*Y)**(.5*(&A)-2.)*(X*X+Y*Y)
3     RETURN
3  10 F = 0.
3     RETURN
3     END
```

```
'EOR
*************
* MACRO  48 *
*************
*         2000001202000
1         TWO DIMENSIONS
1         UXX$ + UYY$ + R(X,Y)U$ = 0.0
2         DIRICHLET
2         X=0. , U=1.
2         X=1. , U=1.
2         Y=0. , U=1.
2         Y=1. , U=1.
3     FUNCTION TRUE(X,Y)
3C
3C    ********************************************************
3C    *                                                      *
3C    *                MACRO 43 PARAMETERS                   *
3C    *                                                      *
3C    ********************************************************
3C    *                                                      *
3C    *              A  I    B  I  C  I  D                  *
3C    *             ----I-------I-----I-----                 *
3C    *                 2  I  .04  I  1  I  1                *
3C    *                    I       I     I                   *
```

```
C     *              25  I  .04  I  1  I  2              *
C     *                  I      I     I                 *
C     *               2  I  .04  I  2  I  3              *
C     *                  I      I     I                 *
C     *              25  I  .04  I  2  I  4              *
C     *                  I      I     I                 *
C     *               2  I  .50  I  2  I  5              *
C     *                                                 *
C     ***************************************************
C
      REAL DERVSL(6), GRID(20), TABLE(20,20),
     $     T1B1(100), T1B2(100), T1B3(100), T1B4(100),
     $     T2B1(100), T2B2(100), T2B3(100), T2B4(100),
     $     T3B1(100), T3B2(100), T3B3(100), T3B4(100),
     $     T4B1(100), T4B2(100), T4B3(100), T4B4(100),
     $     T5B1(100), T5B2(100), T5B3(100), T5B4(100)
      EQUIVALENCE (TABLE(1, 1) , T&DB1(1)),
     $            (TABLE(1, 6) , T&DB2(1)),
     $            (TABLE(1,11) , T&DB3(1)),
     $            (TABLE(1,16) , T&DB4(1))
      DATA NGRID, NGRDD, GRID /20, 20, 0.0000000, 0.0526316,
     $0.1052632, 0.1578947, 0.2105263, 0.2631579, 0.3157895,
     $0.3684211, 0.4210526, 0.4736842, 0.5263158, 0.5789474,
     $0.6315789, 0.6842105, 0.7368421, 0.7894737, 0.8421053,
     $0.8947368, 0.9473684, 1.0000000/
C
C     APPROXIMATE SOLUTION OF LINEARIZED PROBLEM USING
C     HODIE-ACF (METHOD=4, IORDER=41, 20 X 20 GRID)
C
      DATA T1B1/ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
     $ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
     $ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
     $ 1.000000, 1.000000, 1.000000, 1.000000,  .993444,  .988963,
     $  .935662,  .983162,  .981263,  .979847,  .978839,  .978191,
     $  .977874,  .977874,  .978191,  .978839,  .979847,  .981263,
     $  .983162,  .985662,  .988963,  .993444, 1.000000, 1.000000,
     $  .988963,  .980721,  .974445,  .969621,  .965930,  .963166,
     $  .961193,  .959923,  .959301,  .959301,  .959923,  .961193,
     $  .963166,  .965930,  .969621,  .974445,  .980721,  .988963,
     $ 1.000000, 1.000000,  .985662,  .974445,  .965662,  .958802,
     $  .953504,  .949515,  .946657,  .944813,  .943909,  .943909,
     $  .944813,  .946657,  .949515,  .953504,  .958802,  .965662,
     $  .974445,  .985662, 1.000000, 1.000000,  .983162,  .969621,
     $  .958802,  .950283,  .943561,  .938504,  .934869,  .932517,
     $  .931362,  .931362,  .932517,  .934869,  .938504,  .943561,
     $  .950283,  .958802,  .969621,  .983162, 1.000000/
C
      DATA T1B2/ 1.000000,  .981263,  .965930,  .953504,  .943561,
     $  .935752,  .929805,  .925515,  .922733,  .921365,  .921365,
     $  .922733,  .925515,  .929805,  .935752,  .943561,  .953504,
     $  .965930,  .981263, 1.000000, 1.000000,  .979847,  .963166,
     $  .949515,  .933504,  .923805,  .923152,  .918336,  .915207,
     $  .913667,  .913667,  .915207,  .918336,  .923152,  .929805,
     $  .933504,  .949515,  .963166,  .979847, 1.000000, 1.000000,
     $  .979839,  .961193,  .946657,  .934869,  .925515,  .918336,
     $  .913128,  .909739,  .908069,  .908069,  .909739,  .913128,
     $  .918336,  .925515,  .934869,  .946657,  .961193,  .979839,
     $ 1.000000, 1.000000,  .978191,  .963323,  .944813,  .932517,
     $  .923733,  .915207,  .909739,  .906176,  .904420,  .904420,
     $  .906176,  .909739,  .915207,  .923733,  .932517,  .944813,
     $  .963323,  .978191, 1.000000, 1.000000,  .977874,  .959301,
     $  .943909,  .931362,  .921365,  .913667,  .908069,  .904420,
     $  .902620,  .902620,  .904420,  .908069,  .913667,  .921365,
     $  .931362,  .943909,  .959301,  .977874, 1.000000/
C
      DATA T1B3/ 1.000000,  .977874,  .959301,  .943909,  .931362,
     $  .921365,  .913667,  .908069,  .904420,  .902620,  .902620,
     $  .904420,  .908069,  .913667,  .921365,  .931362,  .943909,
     $  .959301,  .977874, 1.000000, 1.000000,  .978191,  .959923,
     $  .944813,  .932517,  .923733,  .915207,  .909739,  .906176,
     $  .904420,  .904420,  .906176,  .909739,  .915207,  .923733,
     $  .932517,  .944813,  .959923,  .978191, 1.000000, 1.000000,
     $  .978839,  .961193,  .946657,  .934869,  .925515,  .918336,
     $  .913128,  .909739,  .908069,  .908069,  .909739,  .913128,
     $  .918336,  .925515,  .934869,  .946657,  .961193,  .978839,
     $ 1.000000, 1.000000,  .978047,  .963193,  .943515,  .938504,
```

```
                   [illegible]  [illegible]  .9[illegible],  .9[illegible]337,  .913387,
                   [illegible]  [illegible]  [illegible]5,   .930[illegible],   .949515,
                   [illegible]  [illegible]  [illegible],    .981263,           .985930,
                   [illegible]  [illegible]  [illegible],    .925515,           .922733,
                   [illegible]  [illegible]  .[illegible],   .928335,           .935752,
                   [illegible]  [illegible]  .9[illegible]   1.000000/

                   [illegible]  .9[illegible]  .[illegible]21,  .953302,   .950236,
                   [illegible]  [illegible]    [illegible],     .931362,   .931362,
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3     [illegible]  .933312,  .950504,  .943515,  .945937,  .944813,
3     [illegible]  .910303,  .944313,  .913657,  .945515,  .953504,
3     [illegible]  .985982,  .974145,  .983962, 1.000000, 1.000000,
3     5 .9[illegible],  .930721,  .974445,  .983921,  .955930,  .963166,
3     5 .981193,  .959823,  .959301,  .959301,  .959823,  .961193,
3     5 .930163,  .985930,  .983921,  .974445,  .930721,  .935963,
3     5 1.000000, 1.000000,  .983441,  .983983,  .985952,  .983162,
3     5 .981363,  .978347,  .978038,  .973191,  .977374,  .977874,
3     5 .973191,  .978323,  .978347,  .981263,  .983162,  .985662,
3     5 .980393,  .983444, 1.000000, 1.000000, 1.000000, 1.000000,
3     5 1.000000, 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
3     5 1.000000, 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
3     5 1.000000, 1.000000, 1.000000, 1.000000, 1.000000/
3C
3      DATA T2B1/ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
3     5 1.000000, 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
3     5 1.000000, 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
3     5 1.000000, 1.000000, 1.000000, 1.000000,  .953229,  .988547,
3     5 .985062,  .982393,  .980363,  .978223,  .977744,  .977039,
3     5 .978693,  .976693,  .977039,  .977744,  .973836,  .980363,
3     5 .982393,  .985062,  .988547,  .993229, 1.000000, 1.000000,
3     5 .988547,  .979310,  .973273,  .968131,  .964170,  .961187,
3     5 .959043,  .957657,  .956989,  .956989,  .957657,  .959048,
3     5 .961187,  .964170,  .968131,  .973273,  .979910,  .988547,
3     5 1.000000, 1.000000,  .985062,  .973273,  .963966,  .956644,
3     5 .950953,  .946644,  .943545,  .941539,  .940554,  .940554,
3     5 .941539,  .943545,  .946644,  .950953,  .956644,  .963936,
3     5 .973273,  .985062, 1.000000, 1.000000,  .932089,  .966131,
3     5 .956644,  .947437,  .940308,  .934343,  .930393,  .928338,
3     5 .927079,  .927079,  .928338,  .930833,  .934843,  .940308,
3     5 .947437,  .956644,  .968131,  .982393, 1.000000/
3C
3      DATA T2B2/ 1.000000,  .980363,  .964170,  .950953,  .940308,
3     5 .931901,  .925468,  .920809,  .917779,  .916287,  .916287,
3     5 .917779,  .920809,  .925468,  .931901,  .940303,  .950953,
3     5 .964170,  .980363, 1.000000, 1.000000,  .978336,  .961187,
3     5 .946644,  .934343,  .925463,  .916265,  .913031,  .909622,
3     5 .907942,  .907942,  .909622,  .913031,  .918265,  .925468,
3     5 .934343,  .946644,  .961187,  .978326, 1.000000, 1.000000,
3     5 .977744,  .959043,  .943545,  .930833,  .920809,  .913031,
3     5 .907369,  .903675,  .901852,  .901852,  .903675,  .907369,
3     5 .913031,  .920309,  .930833,  .943545,  .959043,  .977744,
3     5 1.000000, 1.000000,  .977039,  .957667,  .941539,  .928338,
3     5 .917779,  .909622,  .903675,  .899790,  .897872,  .897872,
3     5 .899790,  .903675,  .909622,  .917779,  .928353,  .941539,
3     5 .957667,  .977033, 1.000000, 1.000000,  .973393,  .953989,
3     5 .940554,  .927079,  .916237,  .907942,  .901852,  .897872,
3     5 .895907,  .895907,  .897372,  .901852,  .907942,  .916287,
3     5 .927079,  .940554,  .956933,  .973893, 1.000000/
3C
3      DATA T2B3/ 1.000000,  .973893,  .956933,  .940554,  .927079,
3     5 .916237,  .907942,  .901852,  .897872,  .895907,  .895907,
3     5 .897872,  .901852,  .907942,  .916237,  .927079,  .940554,
3     5 .956933,  .973893, 1.000000, 1.000000,  .977039,  .957667,
3     5 .941539,  .928353,  .917779,  .909622,  .903675,  .899790,
3     5 .897872,  .897372,  .899790,  .903675,  .909622,  .917779,
3     5 .928338,  .941539,  .957667,  .977033, 1.000000, 1.000000,
3     5 .977744,  .959043,  .943545,  .930833,  .920309,  .913031,
3     5 .907369,  .903675,  .901852,  .901852,  .903675,  .907369,
3     5 .913031,  .920310,  .930833,  .943545,  .959043,  .977744,
3     5 1.000000, 1.000000,  .978326,  .961137,  .946644,  .934843,
3     5 .925468,  .918265,  .913031,  .909622,  .907942,  .907942,
3     5 .909622,  .913031,  .918265,  .925433,  .934343,  .946644,
3     5 .961187,  .978336, 1.000000, 1.000000,  .980363,  .964170,
3     5 [illegible],  .934[illegible]3,  .[illegible],  [illegible]469,  .920809,  .917779,
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3     $  .916287,  .916287,  .917779,  .920809,  .925483,  .931901,
3     $  .940008,  .950953,  .954179,  .980383, 1.000000/
3C
3      DATA T234/ 1.000000,  .932399,  .953131,  .955644,  .947487,
3     $  .940008,  .934343,  .930393,  .928338,  .927079,  .927079,
3     $  .928333,  .930393,  .934843,  .940008,  .947487,  .956644,
3     $  .953131,  .932399, 1.000000, 1.000000,  .965062,  .973273,
3     $  .953956,  .955644,  .950953,  .946644,  .943545,  .941539,
3     $  .940554,  .940554,  .941539,  .943545,  .946644,  .950953,
3     $  .955644,  .953365,  .973273,  .935062, 1.000000, 1.000000,
3     $  .938547,  .979910,  .973273,  .963131,  .954170,  .951187,
3     $  .959048,  .957657,  .955933,  .955989,  .957657,  .959048,
3     $  .951187,  .954170,  .953131,  .973273,  .979910,  .988547,
3     $ 1.000000, 1.000000,  .993229,  .983547,  .985062,  .982399,
3     $  .980363,  .978836,  .977744,  .977039,  .976693,  .976693,
3     $  .977033,  .977744,  .978836,  .980363,  .982399,  .985062,
3     $  .983547,  .993229, 1.000000, 1.000000, 1.000000, 1.000000,
3     $ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
3     $ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
3     $ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000/
3C
3      DATA T331/ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
3     $ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
3     $ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
3     $ 1.000000, 1.000000, 1.000000, 1.000000,  .993549,  .989360,
3     $  .986233,  .983335,  .982115,  .980804,  .979874,  .979279,
3     $  .978983,  .978983,  .979279,  .979874,  .980804,  .982115,
3     $  .983335,  .986233,  .989360,  .993549, 1.000000, 1.000000,
3     $  .989360,  .981493,  .975558,  .971033,  .967595,  .965035,
3     $  .963217,  .962050,  .961479,  .961479,  .962050,  .963217,
3     $  .965035,  .967595,  .971033,  .975558,  .981493,  .989360,
3     $ 1.000000, 1.000000,  .986233,  .975558,  .967259,  .960843,
3     $  .955913,  .952221,  .949589,  .947895,  .947066,  .947066,
3     $  .947895,  .949589,  .952221,  .955913,  .960843,  .967269,
3     $  .975558,  .986233, 1.000000, 1.000000,  .983885,  .971033,
3     $  .960843,  .952832,  .946627,  .941951,  .938504,  .936445,
3     $  .935386,  .935386,  .936445,  .938504,  .941951,  .946627,
3     $  .952832,  .960843,  .971033,  .983885, 1.000000/
3C
3      DATA T332/ 1.000000,  .982115,  .967595,  .955913,  .946627,
3     $  .939377,  .933883,  .929934,  .927381,  .926128,  .926128,
3     $  .927381,  .929934,  .933883,  .939377,  .946627,  .955913,
3     $  .967595,  .982115, 1.000000, 1.000000,  .980804,  .965035,
3     $  .952221,  .941951,  .933333,  .927740,  .923311,  .920441,
3     $  .919031,  .919031,  .920441,  .923311,  .927740,  .933883,
3     $  .941951,  .952221,  .965035,  .980804, 1.000000, 1.000000,
3     $  .979874,  .962217,  .949589,  .938504,  .929934,  .923311,
3     $  .918523,  .915416,  .913887,  .913887,  .915416,  .918523,
3     $  .923311,  .929934,  .938504,  .949589,  .962217,  .979874,
3     $ 1.000000, 1.000000,  .979279,  .962050,  .947895,  .936445,
3     $  .927381,  .920441,  .915416,  .912151,  .910544,  .910544,
3     $  .912151,  .915416,  .920441,  .927381,  .935445,  .947895,
3     $  .962050,  .979279, 1.000000, 1.000000,  .976983,  .961479,
3     $  .947066,  .935333,  .929128,  .919031,  .913837,  .910544,
3     $  .908897,  .908897,  .910544,  .913887,  .919031,  .926128,
3     $  .935333,  .947066,  .961479,  .978983, 1.000000/
3C
3      DATA T333/ 1.000000,  .978983,  .961479,  .947066,  .935386,
3     $  .929128,  .919031,  .913837,  .910544,  .908897,  .908897,
3     $  .910544,  .913887,  .919031,  .929128,  .935333,  .947066,
3     $  .961479,  .978983, 1.000000, 1.000000,  .979279,  .962050,
3     $  .947895,  .936445,  .927381,  .920441,  .915416,  .912151,
3     $  .910544,  .910544,  .912151,  .915416,  .920441,  .927381,
3     $  .936445,  .947895,  .962050,  .979279, 1.000000, 1.000000,
3     $  .979874,  .962217,  .949589,  .938504,  .929934,  .923311,
3     $  .918523,  .915416,  .913887,  .913887,  .915416,  .918523,
3     $  .923311,  .929934,  .938504,  .949589,  .962217,  .979874,
3     $ 1.000000, 1.000000,  .980804,  .965035,  .952221,  .941951,
3     $  .933333,  .927740,  .923311,  .920441,  .919031,  .919031,
3     $  .920441,  .923311,  .927740,  .933333,  .941951,  .952221,
3     $  .965035,  .980804, 1.000000, 1.000000,  .982115,  .967595,
3     $  .955913,  .949327,  .939377,  .933333,  .929934,  .927381,
3     $  .926128,  .926128,  .927381,  .929934,  .933333,  .939377,
3     $  .949327,  .955913,  .967595,  .982115, 1.000000/
3C
3      DATA T334/ 1.000000,  .980335,  .971033,  .960343,  .952832,
```

```
3     $  .946627,  .941951,  .938604,  .936445,  .935386,  .935386,
3     $  .936445,  .938604,  .941951,  .946627,  .952832,  .960843,
3     $  .971033,  .983885, 1.000000, 1.000000,  .986233,  .975558,
3     $  .967269,  .960843,  .955913,  .952221,  .949589,  .947895,
3     $  .947066,  .947066,  .947895,  .949589,  .952221,  .955913,
3     $  .960843,  .967269,  .975558,  .986233, 1.000000, 1.000000,
3     $  .989360,  .981493,  .975558,  .971033,  .967595,  .965035,
3     $  .963217,  .962050,  .961479,  .961479,  .962050,  .963217,
3     $  .965035,  .967595,  .971033,  .975558,  .981493,  .989360,
3     $ 1.000000, 1.000000,  .993649,  .989360,  .986233,  .983885,
3     $  .982115,  .980804,  .979874,  .979279,  .978988,  .978988,
3     $  .979279,  .979874,  .980804,  .982115,  .983885,  .986233,
3     $  .989360,  .993649, 1.000000, 1.000000, 1.000000, 1.000000,
3     $ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
3     $ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
3     $ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000/
3C
3      DATA T4B1/ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
3     $ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
3     $ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
3     $ 1.000000, 1.000000, 1.000000, 1.000000,  .993468,  .989010,
3     $  .985730,  .983248,  .981366,  .979963,  .978966,  .978325,
3     $  .978011,  .978011,  .978325,  .978966,  .979963,  .981366,
3     $  .983248,  .985730,  .989010,  .993468, 1.000000, 1.000000,
3     $  .989010,  .980813,  .974578,  .969791,  .966132,  .963395,
3     $  .961443,  .960186,  .959571,  .959571,  .960186,  .961443,
3     $  .963395,  .966132,  .969791,  .974578,  .980813,  .989010,
3     $ 1.000000, 1.000000,  .985730,  .974578,  .965855,  .959050,
3     $  .953800,  .949849,  .947022,  .945198,  .944304,  .944304,
3     $  .945198,  .947022,  .949849,  .953800,  .959050,  .965855,
3     $  .974578,  .985730, 1.000000, 1.000000,  .983248,  .969791,
3     $  .959050,  .950555,  .943941,  .938935,  .935338,  .933013,
3     $  .931871,  .931871,  .933013,  .935338,  .938935,  .943941,
3     $  .950555,  .959050,  .969791,  .983248, 1.000000/
3C
3      DATA T4B2/ 1.000000,  .981366,  .966132,  .953800,  .943941,
3     $  .936206,  .930320,  .926076,  .923325,  .921973,  .921973,
3     $  .923325,  .926076,  .930320,  .936206,  .943941,  .953800,
3     $  .966132,  .981366, 1.000000, 1.000000,  .979963,  .963395,
3     $  .949849,  .938935,  .930320,  .923735,  .918973,  .915880,
3     $  .914358,  .914358,  .915880,  .918973,  .923735,  .930320,
3     $  .938935,  .949849,  .963395,  .979963, 1.000000, 1.000000,
3     $  .978966,  .961443,  .947022,  .935338,  .926076,  .918973,
3     $  .913823,  .910473,  .908823,  .908823,  .910473,  .913823,
3     $  .918973,  .926076,  .935338,  .947022,  .961443,  .978966,
3     $ 1.000000, 1.000000,  .978325,  .960186,  .945198,  .933013,
3     $  .923325,  .915880,  .910473,  .906953,  .905217,  .905217,
3     $  .906953,  .910473,  .915880,  .923325,  .933013,  .945198,
3     $  .960186,  .978325, 1.000000, 1.000000,  .978011,  .959571,
3     $  .944304,  .931871,  .921973,  .914358,  .908823,  .905217,
3     $  .903440,  .903440,  .905217,  .908823,  .914358,  .921973,
3     $  .931871,  .944304,  .959571,  .978011, 1.000000/
3C
3      DATA T4B3/ 1.000000,  .978011,  .959571,  .944304,  .931871,
3     $  .921973,  .914358,  .908823,  .905217,  .903440,  .903440,
3     $  .905217,  .908823,  .914358,  .921973,  .931871,  .944304,
3     $  .959571,  .978011, 1.000000, 1.000000,  .978325,  .960186,
3     $  .945198,  .933013,  .923325,  .915880,  .910473,  .906953,
3     $  .905217,  .905217,  .906953,  .910473,  .915880,  .923325,
3     $  .933013,  .945198,  .960186,  .978325, 1.000000, 1.000000,
3     $  .978966,  .961443,  .947022,  .935338,  .926076,  .918973,
3     $  .913823,  .910473,  .908823,  .908823,  .910473,  .913823,
3     $  .918973,  .926076,  .935338,  .947022,  .961443,  .978966,
3     $ 1.000000, 1.000000,  .979963,  .963395,  .949849,  .938935,
3     $  .930320,  .923735,  .918973,  .915880,  .914358,  .914358,
3     $  .915880,  .918973,  .923735,  .930320,  .938935,  .949849,
3     $  .963395,  .979963, 1.000000, 1.000000,  .981366,  .966132,
3     $  .953800,  .943941,  .936206,  .930320,  .926076,  .923325,
3     $  .921973,  .921973,  .923325,  .926076,  .930320,  .936206,
3     $  .943941,  .953800,  .966132,  .981366, 1.000000/
3C
3      DATA T4B4/ 1.000000,  .983248,  .969791,  .959050,  .950555,
3     $  .943941,  .938935,  .935338,  .933013,  .931871,  .931871,
3     $  .933013,  .935338,  .938935,  .943941,  .950555,  .959050,
3     $  .969791,  .983248, 1.000000, 1.000000,  .985730,  .974578,
3     $  .965855,  .959050,  .953800,  .949849,  .947022,  .945198,
```

```
3     $  .944304,  .944304,  .945198,  .947022,  .949949,  .953800,
3     $  .953033,  .956355,  .974573,  .985730, 1.000000, 1.000000,
3     $  .939010,  .977313,  .974573,  .959791,  .966132,  .963395,
3     $  .961443,  .961183,  .959571,  .959571,  .960186,  .961443,
3     $  .963395,  .966132,  .969791,  .974573,  .980313,  .989010,
3     $ 1.000000, 1.000000,  .983468,  .989010,  .985730,  .983248,
3     $  .981393,  .979033,  .978265,  .978325,  .978011,  .978011,
3     $  .978325,  .978265,  .978963,  .981365,  .983248,  .985730,
3     $  .989010,  .983463, 1.000000, 1.000000, 1.000000, 1.000000,
3     $ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
3     $ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
3     $ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000/
3C
3      DATA T531/ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
3     $ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
3     $ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
3     $ 1.000000, 1.000000, 1.000000, 1.000000,  .993473,  .989020,
3     $  .985745,  .983263,  .981390,  .979991,  .978997,  .978357,
3     $  .978044,  .978044,  .978357,  .978997,  .979991,  .981390,
3     $  .983263,  .985745,  .989020,  .993473, 1.000000, 1.000000,
3     $  .989020,  .980334,  .974609,  .963181,  .955901,  .963451,
3     $  .961504,  .960252,  .959533,  .959538,  .960252,  .961504,
3     $  .963451,  .965181,  .969331,  .974609,  .980334,  .989020,
3     $ 1.000000, 1.000000,  .985745,  .974609,  .965901,  .959110,
3     $  .953873,  .949933,  .947114,  .945296,  .944405,  .944405,
3     $  .945296,  .947114,  .949933,  .953873,  .959110,  .965901,
3     $  .974609,  .985745, 1.000000, 1.000000,  .983268,  .969831,
3     $  .959110,  .960634,  .944036,  .939045,  .935459,  .933142,
3     $  .932004,  .932004,  .933142,  .935459,  .939045,  .944036,
3     $  .960634,  .959110,  .959831,  .983268, 1.000000/
3C
3      DATA T532/ 1.000000,  .981390,  .966181,  .953873,  .944036,
3     $  .936322,  .930453,  .926223,  .923481,  .922134,  .922134,
3     $  .923481,  .926223,  .930453,  .936322,  .944036,  .953873,
3     $  .966181,  .981390, 1.000000, 1.000000,  .979991,  .963451,
3     $  .949933,  .939045,  .930453,  .923889,  .919142,  .916060,
3     $  .914543,  .914543,  .916060,  .919142,  .923889,  .930453,
3     $  .939045,  .949933,  .963451,  .979991, 1.000000, 1.000000,
3     $  .978997,  .981504,  .947114,  .935459,  .926223,  .919142,
3     $  .914009,  .910671,  .909027,  .909027,  .910671,  .914009,
3     $  .919142,  .926223,  .935459,  .947114,  .961504,  .978997,
3     $ 1.000000, 1.000000,  .978357,  .960252,  .945296,  .933142,
3     $  .923481,  .916060,  .910671,  .907163,  .905435,  .905435,
3     $  .907163,  .910671,  .916060,  .923481,  .933142,  .945296,
3     $  .960252,  .978357, 1.000000, 1.000000,  .978044,  .959638,
3     $  .944405,  .932004,  .922134,  .914543,  .909027,  .905435,
3     $  .903664,  .903664,  .905435,  .909027,  .914543,  .922134,
3     $  .932004,  .944405,  .959638,  .978044, 1.000000/
3C
3      DATA T533/ 1.000000,  .978044,  .959638,  .944405,  .932004,
3     $  .922134,  .914543,  .909027,  .905435,  .903664,  .903664,
3     $  .905435,  .909027,  .914543,  .922134,  .932004,  .944405,
3     $  .959533,  .978044, 1.000000, 1.000000,  .978357,  .960252,
3     $  .945295,  .933142,  .923431,  .916060,  .910671,  .907163,
3     $  .905435,  .905435,  .907163,  .910671,  .916060,  .923481,
3     $  .933142,  .945295,  .960252,  .978357, 1.000000, 1.000000,
3     $  .979007,  .981504,  .947114,  .935459,  .926223,  .919142,
3     $  .914009,  .910671,  .909027,  .909027,  .910671,  .914009,
3     $  .919142,  .926223,  .935459,  .947114,  .961504,  .978997,
3     $ 1.000000, 1.000000,  .979991,  .963451,  .949333,  .939045,
3     $  .930453,  .923833,  .919142,  .916060,  .914543,  .914543,
3     $  .916060,  .919142,  .923833,  .930453,  .939045,  .949933,
3     $  .963451,  .979991, 1.000000, 1.000000,  .981390,  .966181,
3     $  .953873,  .944036,  .936322,  .930453,  .926223,  .923481,
3     $  .922134,  .922134,  .923481,  .926223,  .930453,  .936322,
3     $  .944036,  .953873,  .966181,  .981390, 1.000000/
3C
3      DATA T534/ 1.000000,  .983263,  .963831,  .953110,  .950634,
3     $  .944036,  .939045,  .935459,  .933142,  .932004,  .932004,
3     $  .933142,  .935459,  .939045,  .944036,  .950634,  .959110,
3     $  .963831,  .983263, 1.000000, 1.000000,  .985745,  .974609,
3     $  .965901,  .959110,  .953873,  .949933,  .947114,  .945296,
3     $  .944405,  .944405,  .945296,  .947114,  .949933,  .953873,
3     $  .959110,  .965901,  .974609,  .985745, 1.000000, 1.000000,
3     $  .989020,  .974609,  .963831,  .955181,  .953451,  .955181,
3     $  .959533,  .960252,  .959533,  .959533,  .960252,  .961504,
```

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     $  .953451,  .956181,  .969831,  .974609,  .980834,  .989020,
     $ 1.000000, 1.000000,  .993473,  .989020,  .985745,  .983268,
     $  .981390,  .979991,  .978537,  .978357,  .978044,  .978044,
     $  .978357,  .978997,  .979991,  .981390,  .983268,  .985745,
     $  .989020,  .993473, 1.000000, 1.000000, 1.000000, 1.000000,
     $ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
     $ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
     $ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000/
C
C     INTERPOLATE NONLINEAR SOLUTION BY QUADRATICS
C
      CALL QUADRD(X,Y,TABLE,GRID,GRID,NGRID,NGRID,NGRDD,NGRDD,DERVSL)
C
      TRUE = DERVSL(6)
C
      RETURN
      END
      FUNCTION R(X,Y)
C
      REAL DERVSL(6), GRID(9), TAB1(9,9), TAB2(9,9),
     $     TAB3(9,9), TAB4(9,9), TAB5(9,9)
      DATA NGRID, NGRDD, GRID /9, 9, 0., 0.125, 0.250,
     $0.375, 0.500, 0.625, 0.750, 0.875, 1.00/
C
C     APPROXIMATE SOLUTION OF NONLINEAR PROBLEM FOR NONLINEAR
C     COLLOCATION
C
      DATA TAB1/ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
     $ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,  .975227,
     $  .961931,  .955174,  .953091,  .955175,  .961931,  .975227,
     $ 1.000000, 1.000000,  .961931,  .939237,  .927238,  .923486,
     $  .927237,  .939237,  .961931, 1.000000, 1.000000,  .955175,
     $  .927238,  .912095,  .907312,  .912095,  .927237,  .955175,
     $ 1.000000, 1.000000,  .953091,  .923487,  .907313,  .902186,
     $  .907312,  .923487,  .953091, 1.000000, 1.000000,  .955176,
     $  .927238,  .912095,  .907312,  .912095,  .927238,  .955175,
     $ 1.000000, 1.000000,  .961932,  .939238,  .927238,  .923486,
     $  .927238,  .939237,  .961932, 1.000000, 1.000000,  .975228,
     $  .961932,  .955175,  .953091,  .955175,  .961931,  .975227,
     $ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
     $ 1.000000, 1.000000, 1.000000, 1.000000/
C
      DATA TAB2/ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
     $ 1.000000, 1.000000, 1.000000, 1.000000,  .974112,
     $  .959940,  .952637,  .950369,  .952638,  .959940,  .974113,
     $ 1.000000, 1.000000,  .959939,  .935861,  .922668,  .918581,
     $  .922669,  .935662,  .959941, 1.000000, 1.000000,  .952637,
     $  .922668,  .906214,  .901028,  .906245,  .922668,  .952637,
     $ 1.000000, 1.000000,  .950368,  .918580,  .901028,  .895433,
     $  .901028,  .918580,  .950368, 1.000000, 1.000000,  .952637,
     $  .922668,  .906245,  .901028,  .906245,  .922668,  .952637,
     $ 1.000000, 1.000000,  .959940,  .935662,  .922669,  .918581,
     $  .922668,  .935661,  .959940, 1.000000, 1.000000,  .974112,
     $  .959940,  .952637,  .950369,  .952637,  .959940,  .974112,
     $ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
     $ 1.000000, 1.000000, 1.000000, 1.000000/
C
      DATA TAB3/ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
     $ 1.000000, 1.000000, 1.000000, 1.000000,  .976286,
     $  .963816,  .957569,  .955656,  .957570,  .963816,  .976286,
     $ 1.000000, 1.000000,  .963816,  .942608,  .931532,  .928093,
     $  .931533,  .942609,  .963817, 1.000000, 1.000000,  .957569,
     $  .931532,  .917577,  .913196,  .917578,  .931534,  .957570,
     $ 1.000000, 1.000000,  .955656,  .928093,  .913196,  .908502,
     $  .913197,  .928094,  .955657, 1.000000, 1.000000,  .957569,
     $  .931532,  .917577,  .913196,  .917578,  .931534,  .957570,
     $ 1.000000, 1.000000,  .963815,  .942607,  .931533,  .928093,
     $  .931533,  .942609,  .963817, 1.000000, 1.000000,  .976286,
     $  .963816,  .957569,  .955656,  .957569,  .963817,  .976287,
     $ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
     $ 1.000000, 1.000000, 1.000000, 1.000000/
C
      DATA TAB4/ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
     $ 1.000000, 1.000000, 1.000000, 1.000000,  .975353,
     $  .962161,  .955471,  .953410,  .955471,  .962161,  .975354,
     $ 1.000000, 1.000000,  .962161,  .938658,  .927783,  .924075,
```

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3     $  .927783,  .909659,  .962162, 1.000000, 1.000000,  .955471,
3     $  .927783,  .912803,  .908077,  .912804,  .927784,  .955473,
3     $ 1.000000, 1.000000,  .953410,  .924075,  .908078,  .903013,
3     $  .908078,  .924076,  .953412, 1.000000, 1.000000,  .955471,
3     $  .927783,  .912804,  .908078,  .912804,  .927784,  .955472,
3     $ 1.000000, 1.000000,  .962161,  .939659,  .927784,  .924076,
3     $  .927784,  .939659,  .962162, 1.000000, 1.000000,  .975353,
3     $  .962162,  .955472,  .953411,  .955472,  .962161,  .975353,
3     $ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
3     $ 1.000000, 1.000000, 1.000000, 1.000000/
3C
3      DATA TAB5/ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
3     $ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,  .975382,
3     $  .962216,  .955545,  .953491,  .955546,  .962217,  .975383,
3     $ 1.000000, 1.000000,  .962217,  .939764,  .927924,  .924229,
3     $  .927925,  .939764,  .962217, 1.000000, 1.000000,  .955546,
3     $  .927925,  .912992,  .908283,  .912992,  .927924,  .955545,
3     $ 1.000000, 1.000000,  .953491,  .924229,  .908283,  .903236,
3     $  .908282,  .924228,  .953490, 1.000000, 1.000000,  .955546,
3     $  .927925,  .912993,  .908283,  .912991,  .927923,  .955544,
3     $ 1.000000, 1.000000,  .962217,  .939765,  .927925,  .924228,
3     $  .927923,  .939763,  .962216, 1.000000, 1.000000,  .975382,
3     $  .962217,  .955545,  .953490,  .955544,  .962216,  .975382,
3     $ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
3     $ 1.000000, 1.000000, 1.000000, 1.000000/
3C
3C     INTERPOLATE NONLINEAR SOLUTION BY QUADRATICS
3C
3      CALL QUADRD(X,Y,TAB&D,GRID,GRID,NGRID,NGRID,NGRDD,NGRDD,DERVSL)
3C
3      G = DERVSL(G)
3C
3      R = -1.425*G**(&C-1)*EXP(&A*&B*(1.-G)/(1.+&B*(1.-G)))
3C
3      RETURN
3      END
```

```
*EOR
*************
* MACRO  49 *
*************
*          2000001002000
1          TWO DIMENSIONS
1          UXX$ + UYY$ + W(X,Y)U$ = F(X,Y)
2          DIRICHLET
2          X=0. , U=1.
2          X=1. , U=1.
2          Y=0. , U=1.
2          Y=1. , U=1.
3      FUNCTION TRUE(X,Y)
3C
3C     ***********************************************************
3C     *                                                         *
3C     *                  MACRO 49 PARAMETERS                    *
3C     *                                                         *
3C     ***********************************************************
3C     *                                                         *
3C     *               A  I   B   I   C  I  D                    *
3C     *              ----I-------I------I-----                  *
3C     *               1  I  .50  I   2  I  1                    *
3C     *                  I       I      I                       *
3C     *               1  I  .50  I  25  I  2                    *
3C     *                  I       I      I                       *
3C     *               2  I  .04  I   2  I  3                    *
3C     *                  I       I      I                       *
3C     *               2  I  .50  I   2  I  4                    *
3C     *                                                         *
3C     ***********************************************************
3C
3      REAL DERVSL(G), GRID(20), TABLE(20,20),
3     $     T1B1(100), T1B2(100), T1B3(100), T1B4(100),
3     $     T2B1(100), T2B2(100), T2B3(100), T2B4(100),
3     $     T3B1(100), T3B2(100), T3B3(100), T3B4(100),
3     $     T4B1(100), T4B2(100), T4B3(100), T4B4(100)
3      EQUIVALENCE (TABLE(1, 1) , T&B1(1)),
3     $            (TABLE(1, 6) , T&B2(1)),
```

```
3     $            (TABLE(1,11) , T&DB3(1)),
3     $            (TABLE(1,16) , T&DB4(1))
3      DATA NGRID, NGRDD, GRID /20, 20, 0.0000000, 0.0526316,
3     $0.1052632, 0.1578947, 0.2105263, 0.2631579, 0.3157895,
3     $0.3684211, 0.4210526, 0.4736842, 0.5263158, 0.5789474,
3     $0.6315789, 0.6842105, 0.7368421, 0.7894737, 0.8421053,
3     $0.8947368, 0.9473684, 1.0000000/
3C
3C     APPROXIMATE SOLUTION OF LINEARIZED PROBLEM USING
3C     HODIE-ACF (METHOD=4, IORDER=41, 20 X 20 GRID)
3C
3      DATA T1B1/ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
3     $ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
3     $ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
3     $ 1.000000, 1.000000, 1.000000, 1.000000, 1.004808, 1.008128,
3     $ 1.010595, 1.012478, 1.013915, 1.014992, 1.015761, 1.016257,
3     $ 1.016500, 1.016500, 1.016257, 1.015761, 1.014992, 1.013915,
3     $ 1.012478, 1.010595, 1.008128, 1.004808, 1.000000, 1.000000,
3     $ 1.008128, 1.014249, 1.018947, 1.022581, 1.025376, 1.027479,
3     $ 1.028985, 1.029957, 1.030433, 1.030433, 1.029957, 1.028985,
3     $ 1.027479, 1.025376, 1.022581, 1.018947, 1.014249, 1.008128,
3     $ 1.000000, 1.000000, 1.010595, 1.018947, 1.025531, 1.030703,
3     $ 1.034718, 1.037754, 1.039935, 1.041346, 1.042038, 1.042038,
3     $ 1.041346, 1.039935, 1.037754, 1.034718, 1.030703, 1.025531,
3     $ 1.018947, 1.010595, 1.000000, 1.000000, 1.012478, 1.022581,
3     $ 1.030703, 1.037169, 1.042231, 1.046080, 1.048856, 1.050655,
3     $ 1.051540, 1.051540, 1.050655, 1.048856, 1.046080, 1.042231,
3     $ 1.037169, 1.030703, 1.022581, 1.012478, 1.000000/
3C
3      DATA T1B2/ 1.000000, 1.013915, 1.025376, 1.034718, 1.042231,
3     $ 1.048157, 1.052685, 1.055961, 1.058090, 1.059138, 1.059138,
3     $ 1.058090, 1.055961, 1.052685, 1.048157, 1.042231, 1.034718,
3     $ 1.025376, 1.013915, 1.000000, 1.000000, 1.014992, 1.027479,
3     $ 1.037754, 1.046080, 1.052685, 1.057754, 1.061432, 1.063826,
3     $ 1.065006, 1.065006, 1.063826, 1.061432, 1.057754, 1.052685,
3     $ 1.046080, 1.037754, 1.027479, 1.014992, 1.000000, 1.000000,
3     $ 1.015761, 1.028985, 1.039935, 1.048856, 1.055961, 1.061432,
3     $ 1.065410, 1.063004, 1.069283, 1.069283, 1.068004, 1.065410,
3     $ 1.061432, 1.055961, 1.048856, 1.039935, 1.028985, 1.015761,
3     $ 1.000000, 1.000000, 1.016257, 1.029957, 1.041346, 1.050655,
3     $ 1.058090, 1.063826, 1.069004, 1.070731, 1.072076, 1.072076,
3     $ 1.070731, 1.063004, 1.063826, 1.058090, 1.050655, 1.041346,
3     $ 1.029957, 1.016257, 1.000000, 1.000000, 1.016500, 1.030433,
3     $ 1.042038, 1.051540, 1.059138, 1.065006, 1.069283, 1.072076,
3     $ 1.073455, 1.073455, 1.072076, 1.069283, 1.065006, 1.059138,
3     $ 1.051540, 1.042038, 1.030433, 1.016500, 1.000000/
3C
3      DATA T1B3/ 1.000000, 1.016500, 1.030433, 1.042038, 1.051540,
3     $ 1.059138, 1.065006, 1.069283, 1.072076, 1.073455, 1.073455,
3     $ 1.072076, 1.069283, 1.065006, 1.059138, 1.051540, 1.042038,
3     $ 1.030433, 1.016500, 1.000000, 1.000000, 1.016257, 1.029957,
3     $ 1.041346, 1.050655, 1.058090, 1.063826, 1.069004, 1.070731,
3     $ 1.072076, 1.072076, 1.070731, 1.069004, 1.063826, 1.058090,
3     $ 1.050655, 1.041346, 1.029957, 1.016257, 1.000000, 1.000000,
3     $ 1.015761, 1.028985, 1.039935, 1.048856, 1.055961, 1.061432,
3     $ 1.065410, 1.063004, 1.069283, 1.069283, 1.068004, 1.065410,
3     $ 1.061432, 1.055961, 1.048856, 1.039935, 1.028985, 1.015761,
3     $ 1.000000, 1.000000, 1.014992, 1.027479, 1.037754, 1.046080,
3     $ 1.052685, 1.057754, 1.061432, 1.063826, 1.065006, 1.065006,
3     $ 1.063826, 1.061432, 1.057754, 1.052685, 1.046080, 1.037754,
3     $ 1.027479, 1.014992, 1.000000, 1.000000, 1.013915, 1.025376,
3     $ 1.034718, 1.042231, 1.048157, 1.052685, 1.055961, 1.058090,
3     $ 1.059138, 1.059138, 1.058090, 1.055961, 1.052685, 1.048157,
3     $ 1.042231, 1.034718, 1.025376, 1.013915, 1.000000/
3C
3      DATA T1B4/ 1.000000, 1.012478, 1.022581, 1.030703, 1.037169,
3     $ 1.042231, 1.046080, 1.048856, 1.050655, 1.051540, 1.051540,
3     $ 1.050655, 1.048856, 1.046080, 1.042231, 1.037169, 1.030703,
3     $ 1.022581, 1.012478, 1.000000, 1.000000, 1.010595, 1.018947,
3     $ 1.025531, 1.030703, 1.034718, 1.037754, 1.039935, 1.041346,
3     $ 1.042038, 1.042038, 1.041346, 1.039935, 1.037754, 1.034718,
3     $ 1.030703, 1.025531, 1.018947, 1.010595, 1.000000, 1.000000,
3     $ 1.008128, 1.014249, 1.018947, 1.022581, 1.025376, 1.027479,
3     $ 1.028985, 1.029957, 1.030433, 1.030433, 1.029957, 1.028985,
3     $ 1.027479, 1.025376, 1.022581, 1.018947, 1.014249, 1.008128,
3     $ 1.000000, 1.000000, 1.004808, 1.008128, 1.010595, 1.012478,
```

```
3     S 1.013015, 1.014932, 1.015731, 1.015257, 1.015500, 1.016500,
3     S 1.016257, 1.015731, 1.014932, 1.013915, 1.012478, 1.010595,
3     S 1.008123, 1.004303, 1.000000, 1.000000, 1.000000, 1.000000,
3     S 1.000000, 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
3     S 1.000000, 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
3     S 1.000000, 1.000000, 1.000000, 1.000000, 1.000000/
3C
3      DATA T231/ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
3     S 1.000000, 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
3     S 1.000000, 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
3     S 1.000000, 1.000000, 1.000000, 1.000000, 1.198997, 1.323240,
3     S 1.373187, 1.348374, 1.340131, 1.339086, 1.338927, 1.338874,
3     S 1.338890, 1.338930, 1.338874, 1.338927, 1.339086, 1.340131,
3     S 1.348374, 1.373187, 1.323240, 1.198997, 1.000000, 1.000000,
3     S 1.323240, 1.476115, 1.490001, 1.491537, 1.490550, 1.490452,
3     S 1.490426, 1.490415, 1.490420, 1.490420, 1.490415, 1.490426,
3     S 1.490452, 1.490550, 1.491537, 1.490001, 1.476115, 1.323240,
3     S 1.000000, 1.000000, 1.373187, 1.490001, 1.500139, 1.500072,
3     S 1.500079, 1.500075, 1.500076, 1.500075, 1.500075, 1.500075,
3     S 1.500075, 1.500076, 1.500076, 1.500079, 1.500072, 1.500139,
3     S 1.490001, 1.373187, 1.000000, 1.000000, 1.348374, 1.491537,
3     S 1.500072, 1.499991, 1.499991, 1.499991, 1.499991, 1.499991,
3     S 1.499991, 1.499991, 1.499991, 1.499991, 1.499991, 1.499991,
3     S 1.499991, 1.500072, 1.491537, 1.348374, 1.000000/
3C
3      DATA T232/ 1.000000, 1.340131, 1.490550, 1.500079, 1.499991,
3     S 1.500001, 1.500000, 1.500000, 1.500000, 1.500000, 1.500000,
3     S 1.500000, 1.500000, 1.500000, 1.500001, 1.499991, 1.500079,
3     S 1.490550, 1.340131, 1.000000, 1.000000, 1.339086, 1.490452,
3     S 1.500075, 1.499991, 1.500000, 1.500000, 1.500000, 1.500000,
3     S 1.500000, 1.500000, 1.500000, 1.500000, 1.500000, 1.500000,
3     S 1.499991, 1.500075, 1.490452, 1.339086, 1.000000, 1.000000,
3     S 1.338927, 1.490426, 1.500076, 1.499991, 1.500000, 1.500000,
3     S 1.500000, 1.500000, 1.500000, 1.500000, 1.500000, 1.500000,
3     S 1.500000, 1.500000, 1.499991, 1.500076, 1.490426, 1.338927,
3     S 1.000000, 1.000000, 1.338874, 1.490415, 1.500075, 1.499991,
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3     S 1.500000, 1.500000, 1.500000, 1.500000, 1.499991, 1.500075,
3     S 1.490415, 1.338874, 1.000000, 1.000000, 1.338890, 1.490420,
3     S 1.500075, 1.499991, 1.500000, 1.500000, 1.500000, 1.500000,
3     S 1.500000, 1.500000, 1.500000, 1.500000, 1.500000, 1.500000,
3     S 1.499991, 1.500075, 1.490420, 1.338890, 1.000000/
3C
3      DATA T233/ 1.000000, 1.338890, 1.490420, 1.500075, 1.499991,
3     S 1.500000, 1.500000, 1.500000, 1.500000, 1.500000, 1.500000,
3     S 1.500000, 1.500000, 1.500000, 1.500000, 1.499991, 1.500075,
3     S 1.490420, 1.338890, 1.000000, 1.000000, 1.338874, 1.490415,
3     S 1.500075, 1.499991, 1.500000, 1.500000, 1.500000, 1.500000,
3     S 1.500000, 1.500000, 1.500000, 1.500000, 1.500000, 1.500000,
3     S 1.499991, 1.500075, 1.490415, 1.338874, 1.000000, 1.000000,
3     S 1.338927, 1.490426, 1.500076, 1.499991, 1.500000, 1.500000,
3     S 1.500000, 1.500000, 1.500000, 1.500000, 1.500000, 1.500000,
3     S 1.500000, 1.500000, 1.499991, 1.500076, 1.490426, 1.338927,
3     S 1.000000, 1.000000, 1.338986, 1.490452, 1.500076, 1.499991,
3     S 1.500000, 1.500000, 1.500000, 1.500000, 1.500000, 1.500000,
3     S 1.500000, 1.500000, 1.500000, 1.500000, 1.499991, 1.500076,
3     S 1.490452, 1.338986, 1.000000, 1.000000, 1.340131, 1.490550,
3     S 1.500079, 1.499991, 1.500001, 1.500000, 1.500000, 1.500000,
3     S 1.500000, 1.500000, 1.500000, 1.500000, 1.500000, 1.500001,
3     S 1.499991, 1.500079, 1.490550, 1.340131, 1.000000/
3C
3      DATA T234/ 1.000000, 1.348374, 1.491537, 1.500072, 1.499981,
3     S 1.499991, 1.499991, 1.499991, 1.499991, 1.499991, 1.499991,
3     S 1.499991, 1.499991, 1.499991, 1.499991, 1.499981, 1.500072,
3     S 1.491537, 1.348374, 1.000000, 1.000000, 1.373187, 1.496001,
3     S 1.500180, 1.500072, 1.500079, 1.500076, 1.500076, 1.500075,
3     S 1.500075, 1.500075, 1.500075, 1.500076, 1.500076, 1.500079,
3     S 1.500072, 1.500180, 1.496001, 1.373187, 1.000000, 1.000000,
3     S 1.323240, 1.476115, 1.490001, 1.491537, 1.490550, 1.490452,
3     S 1.490426, 1.490415, 1.490420, 1.490420, 1.490415, 1.490426,
3     S 1.490452, 1.490550, 1.491537, 1.490001, 1.476115, 1.323240,
3     S 1.000000, 1.000000, 1.198997, 1.323240, 1.373187, 1.348374,
3     S 1.338890, 1.338930, 1.338927, 1.338874, 1.338986, 1.339086,
3     S 1.340131, 1.348374, 1.373187, 1.398001, 1.000000, 1.000000,
3     S 1.000000, 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
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3    $ [illegible], [illegible], [illegible], [illegible], 1.001777, 1.001915,
3    $ 1.002012, 1.002074, [illegible], [illegible], 1.002074, 1.002012,
3    $ 1.001915, 1.001777, [illegible], [illegible], 1.001022, 1.000590,
3    $ 1.000000, 1.000000, 1.000731, [illegible], 1.001793, 1.002146,
3    $ 1.002412, 1.002610, 1.002751, [illegible], 1.002885, 1.002885,
3    $ 1.002841, 1.002751, 1.002610, 1.002412, 1.002143, 1.001793,
3    $ 1.001346, 1.000731, 1.000000, 1.000000, 1.000333, 1.001592,
3    $ 1.002146, 1.002530, 1.002914, 1.003165, 1.003343, 1.003458,
3    $ 1.003515, 1.003515, 1.003458, 1.003343, 1.003165, 1.002914,
3    $ 1.002530, 1.002143, 1.001592, 1.000333, 1.000000/
3C
3     DATA T332/ 1.000000, 1.000334, 1.001777, 1.002412, 1.002914,
3    $ 1.003304, 1.003583, 1.003800, 1.003945, 1.004012, 1.004012,
3    $ 1.003945, 1.003800, 1.003583, 1.003304, 1.002914, 1.002412,
3    $ 1.001777, 1.000334, 1.000000, 1.000000, 1.001054, 1.001915,
3    $ 1.002610, 1.003165, 1.003593, 1.003927, 1.004164, 1.004316,
3    $ 1.004391, 1.004391, 1.004316, 1.004164, 1.003927, 1.003598,
3    $ 1.003164, 1.002610, 1.001915, 1.001054, 1.000000, 1.000000,
3    $ 1.001104, 1.002012, 1.002751, 1.003343, 1.003809, 1.004164,
3    $ 1.004419, 1.004535, 1.004666, 1.004666, 1.004584, 1.004419,
3    $ 1.004164, 1.003809, 1.003343, 1.002751, 1.002012, 1.001104,
3    $ 1.000000, 1.000000, 1.001136, 1.002074, 1.002841, 1.003458,
3    $ 1.003945, 1.004316, 1.004535, 1.004758, 1.004844, 1.004844,
3    $ 1.004758, 1.004534, 1.004316, 1.003945, 1.003453, 1.002841,
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3    $ 1.002885, 1.003515, 1.004012, 1.004391, 1.004666, 1.004844,
3    $ 1.004931, 1.004931, 1.004844, 1.004666, 1.004391, 1.004012,
3    $ 1.003515, 1.002885, 1.002104, 1.001151, 1.000000/
3C
3     DATA T333/ 1.000000, 1.001151, 1.002105, 1.002885, 1.003515,
3    $ 1.004012, 1.004391, 1.004666, 1.004844, 1.004931, 1.004931,
3    $ 1.004844, 1.004666, 1.004391, 1.004012, 1.003515, 1.002885,
3    $ 1.002104, 1.001151, 1.000000, 1.000000, 1.001136, 1.002074,
3    $ 1.002841, 1.003453, 1.003945, 1.004316, 1.004535, 1.004758,
3    $ 1.004844, 1.004844, 1.004753, 1.004534, 1.004316, 1.003945,
3    $ 1.003453, 1.002841, 1.002074, 1.001136, 1.000000, 1.000000,
3    $ 1.001104, 1.002012, 1.002751, 1.003343, 1.003809, 1.004164,
3    $ 1.004419, 1.004535, 1.004666, 1.004666, 1.004535, 1.004419,
3    $ 1.004164, 1.003809, 1.003343, 1.002751, 1.002012, 1.001104,
3    $ 1.000000, 1.000000, 1.001054, 1.001915, 1.002610, 1.003165,
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3    $ 1.004012, 1.004012, 1.003945, 1.003809, 1.003583, 1.003304,
3    $ 1.002914, 1.002412, 1.001777, 1.000334, 1.000000/
3C
3     DATA T334/ 1.000000, 1.000333, 1.001592, 1.002143, 1.002530,
3    $ 1.002914, 1.003165, 1.003343, 1.003458, 1.003515, 1.003515,
3    $ 1.003458, 1.003343, 1.003165, 1.002914, 1.002530, 1.002146,
3    $ 1.001592, 1.000333, 1.000000, 1.000000, 1.000731, 1.001346,
3    $ 1.001793, 1.002143, 1.002412, 1.002610, 1.002751, 1.002841,
3    $ 1.002885, [illegible], 1.002841, 1.002751, 1.002610, 1.002412,
3    $ 1.002146, 1.001793, 1.001346, 1.000731, 1.000000, 1.000000,
3    $ 1.000590, 1.001022, 1.001346, [illegible], 1.001777, 1.001915,
3    $ 1.002012, 1.002074, 1.002105, 1.002105, 1.002074, 1.002012,
3    $ 1.001915, 1.001777, [illegible], 1.001346, 1.001022, 1.000590,
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3C
3     DATA [illegible]/ [illegible], [illegible], [illegible], [illegible], 1.000000,
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3     $ 1.000000, 1.000000, 1.000000, 1.000000, 1.004577, 1.007680,
3     $ 1.008850, 1.011653, 1.013948, 1.013905, 1.014584, 1.015020,
3     $ 1.015233, 1.015233, 1.015020, 1.014584, 1.013905, 1.013948,
3     $ 1.011653, 1.008850, 1.007680, 1.004577, 1.000000, 1.000000,
3     $ 1.007680, 1.013377, 1.017687, 1.020979, 1.023485, 1.025353,
3     $ 1.026681, 1.027534, 1.027951, 1.027951, 1.027534, 1.026681,
3     $ 1.025353, 1.023485, 1.020979, 1.017687, 1.013377, 1.007680,
3     $ 1.000000, 1.000000, 1.008850, 1.017687, 1.023703, 1.028385,
3     $ 1.031978, 1.034671, 1.036594, 1.037831, 1.038437, 1.038437,
3     $ 1.037831, 1.036594, 1.034671, 1.031978, 1.028385, 1.023703,
3     $ 1.017687, 1.008850, 1.000000, 1.000000, 1.011653, 1.020979,
3     $ 1.028385, 1.034216, 1.038738, 1.042149, 1.044592, 1.046169,
3     $ 1.046942, 1.046942, 1.046169, 1.044592, 1.042149, 1.038738,
3     $ 1.034216, 1.028385, 1.020979, 1.011658, 1.000000/
3C
3      DATA T432/ 1.000000, 1.012948, 1.023485, 1.031978, 1.038738,
3     $ 1.044022, 1.048029, 1.050911, 1.052774, 1.053689, 1.053689,
3     $ 1.052774, 1.050911, 1.048029, 1.044022, 1.038733, 1.031978,
3     $ 1.023485, 1.012948, 1.000000, 1.000000, 1.013905, 1.025353,
3     $ 1.034671, 1.042149, 1.048029, 1.052509, 1.055740, 1.057835,
3     $ 1.058864, 1.053864, 1.057835, 1.055740, 1.052509, 1.048029,
3     $ 1.042149, 1.034671, 1.025353, 1.013905, 1.000000, 1.000000,
3     $ 1.014584, 1.026681, 1.036594, 1.044592, 1.050911, 1.055740,
3     $ 1.059233, 1.061500, 1.062816, 1.062816, 1.061500, 1.059233,
3     $ 1.055740, 1.050911, 1.044592, 1.036594, 1.026681, 1.014584,
3     $ 1.000000, 1.000000, 1.015020, 1.027534, 1.037831, 1.046169,
3     $ 1.052774, 1.057835, 1.061500, 1.063882, 1.065055, 1.065055,
3     $ 1.063882, 1.061500, 1.057835, 1.052774, 1.046169, 1.037831,
3     $ 1.027534, 1.015020, 1.000000, 1.000000, 1.015233, 1.027951,
3     $ 1.038437, 1.046942, 1.053689, 1.058864, 1.062816, 1.065055,
3     $ 1.066256, 1.066256, 1.065055, 1.062816, 1.058864, 1.053689,
3     $ 1.046942, 1.038437, 1.027951, 1.015233, 1.000000/
3C
3      DATA T433/ 1.000000, 1.015233, 1.027951, 1.038437, 1.046942,
3     $ 1.053689, 1.058864, 1.062816, 1.065055, 1.066256, 1.066256,
3     $ 1.065055, 1.062816, 1.058864, 1.053689, 1.046942, 1.038437,
3     $ 1.027951, 1.015233, 1.000000, 1.000000, 1.015020, 1.027534,
3     $ 1.037831, 1.046169, 1.052774, 1.057835, 1.061500, 1.063882,
3     $ 1.065055, 1.065055, 1.063882, 1.061500, 1.057835, 1.052774,
3     $ 1.046169, 1.037831, 1.027534, 1.015020, 1.000000, 1.000000,
3     $ 1.014584, 1.026681, 1.036594, 1.044592, 1.050911, 1.055740,
3     $ 1.059233, 1.061500, 1.062816, 1.062816, 1.061500, 1.059233,
3     $ 1.055740, 1.050911, 1.044592, 1.036594, 1.026681, 1.014584,
3     $ 1.000000, 1.000000, 1.013905, 1.025353, 1.034671, 1.042149,
3     $ 1.048029, 1.052509, 1.055740, 1.057835, 1.058864, 1.058864,
3     $ 1.057835, 1.055740, 1.052509, 1.048029, 1.042149, 1.034671,
3     $ 1.025353, 1.013905, 1.000000, 1.000000, 1.012948, 1.023485,
3     $ 1.031978, 1.038733, 1.044022, 1.048029, 1.050911, 1.052774,
3     $ 1.053689, 1.053689, 1.052774, 1.050911, 1.048029, 1.044022,
3     $ 1.038733, 1.031978, 1.023485, 1.012948, 1.000000/
3C
3      DATA T434/ 1.000000, 1.011653, 1.020979, 1.023385, 1.034216,
3     $ 1.038733, 1.042149, 1.044592, 1.046169, 1.046942, 1.046942,
3     $ 1.046169, 1.044592, 1.042149, 1.038738, 1.034216, 1.028385,
3     $ 1.020979, 1.011653, 1.000000, 1.000000, 1.008850, 1.017687,
3     $ 1.023703, 1.028385, 1.031978, 1.034671, 1.036594, 1.037831,
3     $ 1.038437, 1.038437, 1.037831, 1.036594, 1.034671, 1.031978,
3     $ 1.028385, 1.023703, 1.017687, 1.008850, 1.000000, 1.000000,
3     $ 1.007680, 1.013377, 1.017687, 1.020979, 1.023485, 1.025353,
3     $ 1.026681, 1.027534, 1.027951, 1.027951, 1.027534, 1.026681,
3     $ 1.025353, 1.023485, 1.020979, 1.017687, 1.013377, 1.007680,
3     $ 1.000000, 1.000000, 1.004577, 1.007680, 1.008850, 1.011658,
3     $ 1.012948, 1.013905, 1.014584, 1.015020, 1.015233, 1.015233,
3     $ 1.015020, 1.014584, 1.013905, 1.012948, 1.011653, 1.008850,
3     $ 1.007680, 1.004577, 1.000000, 1.000000, 1.000000, 1.000000,
3     $ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
3     $ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
3     $ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000, 1.000000/
3C
3      INTERPOLATE NONLINEAR SOLUTION BY QUADRATICS
3
3      CALL QUADRD(X,Y,TABLE,GRID,GRID,NGRID,NGRID,NGRDD,NGRDD,DERVSL)
3C
3      DERV = DERVSL(1)

                                  - 23 -
```

```
3C
3       RETURN
3       END
3       FUNCTION R(X,Y)
3C
3       REAL DERVSL(9), GRID(9), TAB1(9,9), TAB2(9,9),
3      $     TAB3(9,9), TAB4(9,9)
3       DATA NGRID, NGRDD, GRID /9, 9, 0., 0.125, 0.250,
3      $0.375, 0.500, 0.625, 0.750, 0.875, 1.00/
3C
3C      APPROXIMATE SOLUTION OF NONLINEAR PROBLEM FOR NONLINEAR
3C      COLLOCATION
3C
3       DATA TAB1/ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
3      $ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000, 1.018360,
3      $ 1.028380, 1.033520, 1.035120, 1.033520, 1.028380, 1.018360,
3      $ 1.000000, 1.000000, 1.028380, 1.045520, 1.054670, 1.057540,
3      $ 1.054670, 1.045520, 1.028380, 1.000000, 1.000000, 1.033520,
3      $ 1.054670, 1.065220, 1.069880, 1.065220, 1.054670, 1.033520,
3      $ 1.000000, 1.000000, 1.035120, 1.057540, 1.069880, 1.073810,
3      $ 1.069880, 1.057540, 1.035120, 1.000000, 1.000000, 1.033520,
3      $ 1.054670, 1.065220, 1.069880, 1.065220, 1.054670, 1.033520,
3      $ 1.000000, 1.000000, 1.028380, 1.045520, 1.054670, 1.057540,
3      $ 1.054670, 1.045520, 1.028380, 1.000000, 1.000000, 1.018360,
3      $ 1.028380, 1.033520, 1.035120, 1.033520, 1.028380, 1.018360,
3      $ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
3      $ 1.000000, 1.000000, 1.000000, 1.000000/
3C
3       DATA TAB2/ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
3      $ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000, 1.522810,
3      $ 1.511040, 1.510490, 1.510470, 1.510490, 1.511040, 1.522810,
3      $ 1.000000, 1.000000, 1.511040, 1.501050, 1.500550, 1.500530,
3      $ 1.500550, 1.501050, 1.511040, 1.000000, 1.000000, 1.510490,
3      $ 1.500550, 1.500050, 1.500030, 1.500050, 1.500550, 1.510490,
3      $ 1.000000, 1.000000, 1.510470, 1.500530, 1.500030, 1.500010,
3      $ 1.500030, 1.500530, 1.510470, 1.000000, 1.000000, 1.510490,
3      $ 1.500550, 1.500060, 1.500030, 1.500050, 1.500550, 1.510490,
3      $ 1.000000, 1.000000, 1.511040, 1.501050, 1.500550, 1.500530,
3      $ 1.500550, 1.501050, 1.511040, 1.000000, 1.000000, 1.522810,
3      $ 1.511040, 1.510490, 1.510470, 1.510490, 1.511040, 1.522810,
3      $ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
3      $ 1.000000, 1.000000, 1.000000, 1.000000/
3C
3       DATA TAB3/ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
3      $ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000, 1.001310,
3      $ 1.001990, 1.002320, 1.002430, 1.002320, 1.001990, 1.001310,
3      $ 1.000000, 1.000000, 1.001990, 1.003140, 1.003730, 1.003920,
3      $ 1.003730, 1.003140, 1.001990, 1.000000, 1.000000, 1.002320,
3      $ 1.003730, 1.004480, 1.004720, 1.004480, 1.003730, 1.002330,
3      $ 1.000000, 1.000000, 1.002430, 1.003920, 1.004720, 1.004970,
3      $ 1.004720, 1.003920, 1.002430, 1.000000, 1.000000, 1.002320,
3      $ 1.003730, 1.004480, 1.004720, 1.004480, 1.003730, 1.002320,
3      $ 1.000000, 1.000000, 1.001990, 1.003140, 1.003730, 1.003920,
3      $ 1.003730, 1.003140, 1.001990, 1.000000, 1.000000, 1.001310,
3      $ 1.001990, 1.002320, 1.002430, 1.002320, 1.001990, 1.001310,
3      $ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
3      $ 1.000000, 1.000000, 1.000000, 1.000000/
3C
3       DATA TAB4/ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
3      $ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000, 1.017160,
3      $ 1.026240, 1.030800, 1.032200, 1.030800, 1.026240, 1.017160,
3      $ 1.000000, 1.000000, 1.026240, 1.041680, 1.049760, 1.052270,
3      $ 1.049760, 1.041680, 1.026240, 1.000000, 1.000000, 1.030800,
3      $ 1.049760, 1.059940, 1.063140, 1.059940, 1.049760, 1.030800,
3      $ 1.000000, 1.000000, 1.032200, 1.052280, 1.063140, 1.066570,
3      $ 1.063140, 1.052270, 1.032200, 1.000000, 1.000000, 1.030800,
3      $ 1.049760, 1.059940, 1.063140, 1.059940, 1.049760, 1.030800,
3      $ 1.000000, 1.000000, 1.026240, 1.041680, 1.049760, 1.052280,
3      $ 1.049760, 1.041630, 1.026240, 1.000000, 1.000000, 1.017160,
3      $ 1.026240, 1.030800, 1.032200, 1.030800, 1.026240, 1.017160,
3      $ 1.000000, 1.000000, 1.000000, 1.000000, 1.000000, 1.000000,
3      $ 1.000000, 1.000000, 1.000000, 1.000000/
3C
3C      INTERPOLATE NONLINEAR SOLUTION BY QUADRATICS
3C
3       CALL QUADRD(X,Y,TAB&D,GRID,GRID,NGRID,NGRID,NGRDD,NGRDD,DERVSL)
```

```
3C
3       R = DERVSL(6)
3C
3       RETURN
3       END
3       FUNCTION W(X,Y)
3C
3       T = R(X,Y)
3       W = -(1.425**2)*((1.+&B-T)/&B)**(&A-1)*EXP(&C*(T-1.)/T)
3C
3       RETURN
3       END
3       FUNCTION F(X,Y)
3C
3       T = R(X,Y)
3       F = -(1.425**2)*((1.+&B-T)/&B)**(&A-1)*EXP(&C*(T-1.)/T)*(1.+&B)
3C
3       RETURN
3       END
```

```
'EOR
*************
* MACRO  50 *
*************
```

```
'EOR
*************
* MACRO  51 *
*************
*         2000200000222
1         TWO DIMENSIONS
1         UXX$ + C(X)UYY$ + D(X)UX$ = -10.
2         MIXED $ HOMOGENEOUS
2         X=0. , UX = 0.
2         X=1. , U  = 0.
2         Y=0. , UY = 0.
2         Y=1. , MIXED = (A(X))UY + (B(X))U = 0.
3       FUNCTION TRUE(X,Y)
3C
3C      ********************************************************
3C      *                                                      *
3C      *                  MACRO 51 PARAMETERS                 *
3C      *                                                      *
3C      ********************************************************
3C      *                                                      *
3C      *                        A  I  B                       *
3C      *                       ------I-----                   *
3C      *                         .3  I  1                     *
3C      *                             I                        *
3C      *                         .5  I  2                     *
3C      *                             I                        *
3C      *                         .6  I  3                     *
3C      *                             I                        *
3C      *                         .7  I  4                     *
3C      *                                                      *
3C      ********************************************************
3C
3       REAL DERVSL(6), GRID(20), TABLE(20,20),
3      $     T1B1(100), T1B2(100), T1B3(100), T1B4(100),
3      $     T2B1(100), T2B2(100), T2B3(100), T2B4(100),
3      $     T3B1(100), T3B2(100), T3B3(100), T3B4(100),
3      $     T4B1(100), T4B2(100), T4B3(100), T4B4(100)
3       EQUIVALENCE (TABLE(1, 1) , T&BB1(1)),
3      $            (TABLE(1, 6) , T&BB2(1)),
3      $            (TABLE(1,11) , T&BB3(1)),
3      $            (TABLE(1,16) , T&BB4(1))
3       DATA NGRID, NGRDD/20, 20/
3       DATA  GRID/0.0000000, 0.0526316, 0.1052632, 0.1578947,
3      $0.2105263, 0.2631579, 0.3157895, 0.3684211, 0.4210526,
3      $0.4736842, 0.5263158, 0.5789474, 0.6315789, 0.6842105,
3      $0.7368421, 0.7894737, 0.8421053, 0.8947369, 0.9473684,
3      $1.0000000/
3C
3C      APPROXIMATE SOLUTION OF PROBLEM USING
3C      P3-C1 COLLOCATION (8 X 8 GRID)
3C
```

```
3     DATA T[illegible]/ .[illegible], .[illegible], .[illegible], .[illegible]7, .708312,
3   S .[illegible], .[illegible], .[illegible], .[illegible], .[illegible], .794335,
    S .[illegible], .[illegible], .[illegible], .[illegible], .[illegible]0, .429223,
    S .[illegible], .[illegible], .[illegible], .[illegible], .[illegible], .680350,
    S .[illegible], .[illegible], .[illegible], .[illegible], .[illegible], .760122,
    S .[illegible], .[illegible], .[illegible], .[illegible], .[illegible], .620952,
3   S .[illegible], .[illegible], .[illegible], .[illegible], .[illegible]0, 669758,
    S .[illegible], .[illegible], .[illegible], .[illegible], .[illegible], .743460,
3   S .[illegible], .[illegible], .[illegible], .[illegible], .[illegible], .759010,
3   S .[illegible], .[illegible], .[illegible], .[illegible], .[illegible], .161059,
3   S .[illegible], .[illegible], .[illegible], .[illegible], .[illegible], .700081,
3   S .[illegible], .[illegible], .[illegible], .[illegible], .[illegible], .778013,
3   S .761512, .[illegible], .[illegible], .[illegible], .527050, .423473,
3   S .[illegible], .[illegible], .[illegible], .[illegible], .[illegible], .600781,
3   S .633760, .[illegible], .[illegible], .[illegible], .745755, .702134,
3   S .770110, .786743, .[illegible], .[illegible], .570119, .604563,
3   S .523932, .[illegible], .[illegible], .[illegible], .000000/
3C
3     DATA T[illegible]/ .555523, .[illegible], .[illegible], .332523, .697323,
3   S .807221, .[illegible], .[illegible], .[illegible], .[illegible], .750715,
3   S .[illegible], .[illegible], .[illegible], .[illegible], .512302, .412915,
3   S .[illegible], .[illegible], .[illegible], .[illegible], .572315, .677534,
3   S .[illegible], .575781, .[illegible], .[illegible], .711524, .725345,
3   S .[illegible], .[illegible], .[illegible], .[illegible], .[illegible], .581935,
3   S .[illegible], .[illegible], .[illegible], .[illegible], .000000, .669236,
3   S .[illegible], .[illegible], .[illegible], .[illegible], .397437, .675820,
3   S .[illegible], .[illegible], .[illegible], .[illegible], .[illegible], .667618,
3   S .[illegible], .[illegible], .[illegible], .[illegible], .733033, .151075,
3   S .[illegible], .[illegible], .[illegible], .[illegible], .553123, .655293,
3   S .[illegible], .[illegible], .[illegible], .[illegible], .378583, .679171,
3   S .[illegible], .[illegible], .[illegible], .[illegible], .475559, .385284,
3   S .[illegible], .[illegible], .[illegible], .[illegible], .571233, .670949,
3   S .[illegible], .542573, .[illegible], .[illegible], .530553, .655179,
3   S .549534, .[illegible], .[illegible], .[illegible], .573144, .527107,
3   S .453431, .372291, .[illegible], .143073, .000000/
3C
3     DATA T133/ .[illegible], .570153, .[illegible], .552553, .627376,
3   S .593343, .[illegible], .[illegible], .501353, .503233, .609469,
3   S .[illegible], .[illegible], .550933, .[illegible], .433347, .357049,
3   S .257017, .[illegible], .000000, .[illegible], .539769, .665804,
3   S .545243, .511333, .[illegible], .[illegible], .553785, .558581,
3   S .564051, .537070, .561437, .545173, .519520, .473425,
3   S .414707, .330172, .245073, .132349, .000000, .657974,
3   S .[illegible], .[illegible], .[illegible], .[illegible], .549161, .519186,
3   S .509019, .510573, .[illegible], .[illegible], .515572, .502343,
3   S .477935, .[illegible], .[illegible], .313252, .230574, .125111,
3   S .000000, .557620, .[illegible], .[illegible], .530195, .577186,
3   S .513203, .473531, .[illegible], .[illegible], .432104, .465641,
3   S .[illegible], .[illegible], .[illegible], .401335, .355260, .293725,
3   S .214535, .117237, .000000, .[illegible], .337353, .658168,
3   S .[illegible], .530291, .465413, .[illegible], .401039, .397653,
3   S .402539, .[illegible], .495722, .[illegible], .333124, .356320,
3   S .[illegible], .[illegible], .194233, .107025, .000000/
3C
3     DATA T[illegible]/ .[illegible], .557123, .[illegible], .513233, .543127,
3   S .[illegible], .370110, .[illegible], .[illegible], .335747, .339580,
3   S .[illegible], .[illegible], .225303, .304603, .273340, .230456,
3   S .[illegible], .[illegible], .000000, .[illegible], .633322, .653535,
3   S .[illegible], .[illegible], .116210, .[illegible], .[illegible], .260994,
3   S .[illegible], .[illegible], .[illegible], .[illegible], .[illegible], .245081,
3   S .[illegible], .[illegible], .1[illegible]33, .031102, .000000, .065764,
3   S .[illegible], .351591, .[illegible], .514203, .330044, .237414,
3   S .193040, .[illegible], .[illegible], .[illegible], .137393, .187471,
3   S .[illegible], .174727, .[illegible], .100054, .105579, .061953,
3   S .000000, .[illegible], .[illegible], .[illegible], .597279, .505134,
3   S .[illegible], .143143, .[illegible], .[illegible], .085571, .097059,
3   S .[illegible], .093013, .007333, .[illegible], .037397, .077234,
3   S .[illegible], .037805, .000000, .[illegible], .555153, .649027,
3   S .[illegible], .[illegible], .[illegible], .[illegible], -.003421, .019818,
3   S .[illegible], .000173, .[illegible], -.[illegible], .000110, .000049,
3   S -.[illegible], .000015, .[illegible], .[illegible], .000000/
3C
3     DATA T[illegible]1/ 1.812452, 1.[illegible], 1.[illegible], 1.745935, 1.697561,
3   S 1.[illegible], 1.580[illegible], 1.[illegible], 1.[illegible], 1.351433, 1.277126,
3   S 1.[illegible], 1.[illegible], .[illegible], .[illegible], .[illegible], .554544,
3   S .[illegible], .[illegible], .[illegible], 1.[illegible], 1.[illegible], 1.700190,
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3      $ 1.744339, 1.693114, 1.642156, 1.580253, 1.512033, 1.438310,
3      $ 1.360670, 1.275371, 1.183627, 1.082572,  .969925,  .845414,
3      $  .707065,  .553800,  .385537,  .200337,  .000000, 1.812470,
3      $ 1.804003, 1.778997, 1.743930, 1.697262, 1.641171, 1.578167,
3      $ 1.500113, 1.434811, 1.356041, 1.270996, 1.176668, 1.077531,
3      $  .965507,  .841409,  .703760,  .551440,  .383340,  .200135,
3      $  .000000, 1.812430, 1.804283, 1.780041, 1.743850, 1.696785,
3      $ 1.639703, 1.575653, 1.505016, 1.428985, 1.349233, 1.263228,
3      $ 1.170514, 1.066672,  .953184,  .835023,  .693500,  .547470,
3      $  .381120,  .193765,  .000000, 1.812494, 1.804566, 1.780106,
3      $ 1.743742, 1.696139, 1.637715, 1.572120, 1.499240, 1.420804,
3      $ 1.339491, 1.252123, 1.158330, 1.058436,  .947730,  .825919,
3      $  .691033,  .541782,  .377341,  .136820,  .000000/
3C
3       DATA T232/ 1.812512, 1.808393, 1.779871, 1.743037, 1.694535,
3      $ 1.635131, 1.566743, 1.491150, 1.410235, 1.325772, 1.237056,
3      $ 1.148239, 1.042333,  .933683,  .813622,  .680922,  .534227,
3      $  .372335,  .194452,  .000000, 1.812535, 1.804636, 1.780053,
3      $ 1.743105, 1.693390, 1.632332, 1.561908, 1.482589, 1.397306,
3      $ 1.310432, 1.216922, 1.123876, 1.024166,  .916070,  .798130,
3      $  .668213,  .524623,  .365703,  .191152,  .000000, 1.812562,
3      $ 1.804525, 1.779973, 1.742651, 1.692450, 1.629129, 1.555381,
3      $ 1.471824, 1.381076, 1.290530, 1.136132, 1.093766, 1.000372,
3      $  .894125,  .778930,  .652497,  .512755,  .357874,  .187297,
3      $  .000000, 1.812594, 1.804034, 1.779775, 1.741966, 1.690619,
3      $ 1.625704, 1.547340, 1.453412, 1.364298, 1.266316, 1.168500,
3      $ 1.070434,  .971163,  .867321,  .755653,  .633369,  .498295,
3      $  .348474,  .182633,  .000000, 1.812631, 1.804832, 1.780046,
3      $ 1.742102, 1.690063, 1.622446, 1.541769, 1.447333, 1.344371,
3      $ 1.241302, 1.136923, 1.035634,  .937070,  .835330,  .727381,
3      $  .610123,  .480903,  .336277,  .176597,  .000000/
3C
3       DATA T233/ 1.812674, 1.804514, 1.779308, 1.741544, 1.688473,
3      $ 1.619129, 1.533957, 1.433217, 1.322339, 1.209403, 1.098356,
3      $  .993703,  .895172,  .796782,  .694005,  .582321,  .460202,
3      $  .322895,  .170037,  .000000, 1.812722, 1.804471, 1.779899,
3      $ 1.741236, 1.687334, 1.616149, 1.526916, 1.419233, 1.298555,
3      $ 1.174161, 1.053505,  .943827,  .845505,  .750968,  .654130,
3      $  .550195,  .435645,  .306527,  .161958,  .000000, 1.812777,
3      $ 1.805053, 1.780123, 1.741380, 1.686397, 1.613719, 1.521466,
3      $ 1.406313, 1.273462, 1.135947, 1.001613,  .884621,  .786898,
3      $  .696794,  .606762,  .511439,  .406589,  .286559,  .152028,
3      $  .000000, 1.812333, 1.804563, 1.780002, 1.740978, 1.685927,
3      $ 1.611733, 1.515632, 1.393605, 1.248107, 1.089532,  .938410,
3      $  .813031,  .715716,  .632441,  .551934,  .466892,  .372729,
3      $  .264330,  .141390,  .000000, 1.812907, 1.805068, 1.780247,
3      $ 1.741255, 1.686051, 1.610650, 1.512803, 1.384336, 1.223785,
3      $ 1.042333,  .865472,  .727023,  .631918,  .556971,  .486641,
3      $  .413473,  .332842,  .237065,  .127525,  .000000/
3C
3       DATA T234/ 1.812934, 1.805192, 1.780333, 1.741439, 1.686177,
3      $ 1.610360, 1.511702, 1.378934, 1.202751,  .989344,  .776065,
3      $  .621900,  .531492,  .463656,  .411693,  .352301,  .286265,
3      $  .205740,  .111663,  .000000, 1.813069, 1.804637, 1.780326,
3      $ 1.741397, 1.636091, 1.610869, 1.512334, 1.373439, 1.189577,
3      $  .930659,  .661607,  .490722,  .412699,  .366769,  .326568,
3      $  .282433,  .231625,  .170024,  .084141,  .000000, 1.813160,
3      $ 1.805513, 1.780751, 1.742164, 1.687505, 1.612441, 1.516513,
3      $ 1.383737, 1.183346,  .877400,  .520356,  .324343,  .266646,
3      $  .251313,  .223507,  .193371,  .157254,  .122352,  .070127,
3      $  .000000, 1.813269, 1.805236, 1.780926, 1.742578, 1.688169,
3      $ 1.614340, 1.522439, 1.333323, 1.213637,  .830704,  .312526,
3      $  .110060,  .124332,  .125613,  .113255,  .104335,  .090949,
3      $  .060043,  .041773,  .000000, 1.313440, 1.804354, 1.780815,
3      $ 1.742334, 1.637763, 1.613434, 1.530373, 1.400121, 1.285768,
3      $  .821753, -.003302, -.151509,  .012233, -.014629, -.006469,
3      $  .001165, -.002022, -.000161,  .000030,  .000000/
3C
3       DATA T331/ 1.772236, 1.766725, 1.743071, 1.716604, 1.679909,
3      $ 1.630236, 1.570731, 1.510311, 1.452201, 1.370143, 1.297450,
3      $ 1.2[illegible], 1.103753,  .966563,  .862149,  .720610,  .564193,
3      $  [illegible],  .211750,  .000000, 1.772236, 1.767504, 1.748316,
3      $ 1.7[illegible], 1.681004, 1.630000, 1.570027, 1.5[illegible], 1.452174,
3      $ 1.3[illegible], 1.2[illegible], 1.214703, 1.102316,  .863443,  .631633,
3      $  [illegible],  [illegible],  .201037,  .204131,  .000000, 1.772235,
3      $ 1.7[illegible], 1.7[illegible], 1.7[illegible], 1.5[illegible], 1.3[illegible], 1.3[illegible],
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3     $ 1.516723, 1.449031, 1.374731, 1.292213, 1.200547, 1.098586,
3     $  .984637,  .857921,  .717150,  .551489,  .390482,  .203402,
3     $  .000000, 1.773233, 1.767143, 1.747997, 1.718099, 1.678521,
3     $ 1.630010, 1.574978, 1.512807, 1.443801, 1.368858, 1.285571,
3     $ 1.193611, 1.091896,  .978364,  .852335,  .712594,  .558024,
3     $  .388108,  .202222,  .000000, 1.773231, 1.767370, 1.747912,
3     $ 1.717666, 1.677386, 1.627517, 1.571193, 1.507284, 1.436458,
3     $ 1.360433, 1.276110, 1.183734, 1.082343,  .969388,  .844534,
3     $  .706117,  .553058,  .384798,  .200586,  .000000/
3C
3      DATA T3B2/ 1.773228, 1.768756, 1.747495, 1.716588, 1.675129,
3     $ 1.624252, 1.565484, 1.499506, 1.426968, 1.348532, 1.263272,
3     $ 1.170505, 1.069087,  .957311,  .833839,  .697242,  .546404,
3     $  .380355,  .198387,  .000000, 1.773224, 1.767309, 1.747449,
3     $ 1.716115, 1.673707, 1.620573, 1.560086, 1.491212, 1.415361,
3     $ 1.335315, 1.247932, 1.154145, 1.053206,  .942199,  .820437,
3     $  .686148,  .537935,  .374496,  .195468,  .000000, 1.773219,
3     $ 1.767121, 1.747116, 1.715063, 1.671286, 1.616250, 1.552832,
3     $ 1.480704, 1.401588, 1.318255, 1.228761, 1.133893, 1.033017,
3     $  .923331,  .803746,  .672297,  .527379,  .367490,  .192005,
3     $  .000000, 1.773214, 1.768549, 1.748629, 1.713588, 1.668283,
3     $ 1.611431, 1.544289, 1.468434, 1.385678, 1.297847, 1.205703,
3     $ 1.109405, 1.008261,  .900242,  .783280,  .655274,  .514409,
3     $  .358974,  .187805,  .000000, 1.773207, 1.767280, 1.746580,
3     $ 1.713108, 1.666456, 1.609479, 1.535763, 1.456217, 1.367702,
3     $ 1.276349, 1.179610, 1.080647,  .979657,  .872679,  .758467,
3     $  .634579,  .498668,  .347884,  .182253,  .000000/
3C
3      DATA T3B3/ 1.773200, 1.768814, 1.746110, 1.711710, 1.663318,
3     $ 1.601104, 1.527036, 1.441591, 1.347707, 1.249655, 1.148220,
3     $ 1.046285,  .944397,  .839293,  .728751,  .609787,  .479649,
3     $  .335456,  .176127,  .000000, 1.773191, 1.768650, 1.745749,
3     $ 1.710522, 1.650490, 1.595683, 1.517432, 1.425453, 1.325900,
3     $ 1.220417, 1.112360, 1.005002,  .902860,  .799418,  .692918,
3     $  .579813,  .459730,  .320019,  .168458,  .000000, 1.773182,
3     $ 1.767118, 1.745610, 1.709769, 1.658354, 1.590402, 1.508589,
3     $ 1.411412, 1.302522, 1.189105, 1.071797,  .958990,  .854169,
3     $  .751949,  .649863,  .543716,  .429216,  .300895,  .158910,
3     $  .000000, 1.773172, 1.768514, 1.745120, 1.708389, 1.655252,
3     $ 1.585137, 1.498306, 1.394954, 1.278019, 1.152285, 1.024370,
3     $  .903245,  .794602,  .694648,  .598701,  .500914,  .396192,
3     $  .279503,  .148374,  .000000, 1.773160, 1.766886, 1.744994,
3     $ 1.707694, 1.653350, 1.580377, 1.489936, 1.379974, 1.253020,
3     $ 1.115450,  .971930,  .833405,  .725452,  .628408,  .536576,
3     $  .448780,  .356518,  .251655,  .134418,  .000000/
3C
3      DATA T3B4/ 1.773148, 1.768886, 1.744770, 1.708891, 1.651350,
3     $ 1.576061, 1.481777, 1.375440, 1.258351, 1.075319,  .912514,
3     $  .761311,  .640650,  .543389,  .452778,  .387042,  .309008,
3     $  .219547,  .118413,  .000000, 1.773135, 1.768282, 1.744374,
3     $ 1.705331, 1.649078, 1.572301, 1.473805, 1.351768, 1.205234,
3     $ 1.033233,  .843789,  .658059,  .534340,  .443791,  .375286,
3     $  .313937,  .252003,  .182072,  .093697,  .000000, 1.773122,
3     $ 1.768884, 1.744458, 1.705732, 1.648443, 1.568546, 1.469025,
3     $ 1.341577, 1.185259,  .987433,  .777534,  .558751,  .410830,
3     $  .323718,  .239571,  .225297,  .183201,  .132078,  .074306,
3     $  .000000, 1.773107, 1.768542, 1.744260, 1.705180, 1.647300,
3     $ 1.567542, 1.464623, 1.333501, 1.169114,  .988945,  .712731,
3     $  .415353,  .235465,  .178328,  .148850,  .122781,  .100598,
3     $  .074529,  .044213,  .000000, 1.773085, 1.768180, 1.744056,
3     $ 1.704671, 1.643615, 1.568450, 1.481352, 1.330533, 1.155519,
3     $  .950830,  .681654,  .214983, -.017429,  .020759,  .009179,
3     $ -.001695,  .002869,  .000228, -.000042,  .000000/
3C
3      DATA T4B1/ 2.170321, 2.163987, 2.143356, 2.110983, 2.065997,
3     $ 2.009433, 1.941830, 1.863493, 1.774542, 1.675014, 1.564610,
3     $ 1.442931, 1.309491, 1.163335, 1.004949,  .832395,  .646464,
3     $  .445300,  .230392,  .000000, 2.170321, 2.164943, 2.144179,
3     $ 2.111492, 2.066755, 2.009425, 1.942359, 1.863750, 1.774086,
3     $ 1.675211, 1.564293, 1.442411, 1.308359, 1.163133, 1.004656,
3     $  .832533,  .646076,  .445763,  .230402,  .000000, 2.170820,
3     $ 2.164315, 2.143935, 2.111047, 2.065933, 2.009305, 1.941145,
3     $ 1.862293, 1.772563, 1.672351, 1.562037, 1.440076, 1.306720,
3     $ 1.160872, 1.002436,  .830322,  .644736,  .444734,  .229370,
3     $  .000000, 2.170329, 2.164329, 2.143936, 2.111020, 2.065810,
3     $ 2.008224, 1.940180, 1.860721, 1.770317, 1.670257, 1.558742,
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3     $ 1.436419, 1.303074, 1.157231,  .999171,  .827838,  .642567,
3     $  .443231,  .229120,  .000000, 2.170820, 2.164825, 2.144011,
3     $ 2.110983, 2.065571, 2.007289, 1.938823, 1.858512, 1.767043,
3     $ 1.666425, 1.554060, 1.431208, 1.297840, 1.151993,  .994439,
3     $  .823833,  .639381,  .441110,  .228067,  .000000/
3C
3      DATA T4B2/ 2.170819, 2.164098, 2.143687, 2.110309, 2.064295,
3     $ 2.005964, 1.936141, 1.854948, 1.762840, 1.660457, 1.547481,
3     $ 1.424094, 1.290127, 1.144794,  .987705,  .818033,  .635024,
3     $  .438071,  .226540,  .000000, 2.170818, 2.164806, 2.143849,
3     $ 2.110422, 2.064206, 2.004627, 1.934402, 1.851812, 1.757772,
3     $ 1.654704, 1.540039, 1.415545, 1.281500, 1.135869,  .979508,
3     $  .811029,  .629400,  .434190,  .224595,  .000000, 2.170817,
3     $ 2.164608, 2.143686, 2.109968, 2.063200, 2.002971, 1.931453,
3     $ 1.847434, 1.751836, 1.646789, 1.530574, 1.404844, 1.270023,
3     $ 1.124503,  .968880,  .801829,  .622193,  .429281,  .222137,
3     $  .000000, 2.170816, 2.163945, 2.143354, 2.109216, 2.061702,
3     $ 2.001097, 1.927777, 1.842216, 1.745099, 1.637202, 1.519244,
3     $ 1.391932, 1.255739, 1.110388,  .955489,  .790119,  .613047,
3     $  .423046,  .219010,  .000000, 2.170815, 2.164878, 2.143572,
3     $ 2.109384, 2.061619, 1.999350, 1.925450, 1.837810, 1.737671,
3     $ 1.628260, 1.507046, 1.377197, 1.240026, 1.093524,  .939374,
3     $  .775977,  .601606,  .414888,  .214879,  .000000/
3C
3      DATA T4B3/ 2.170814, 2.164347, 2.143280, 2.108681, 2.060168,
3     $ 1.997326, 1.921510, 1.831946, 1.729613, 1.616503, 1.492337,
3     $ 1.359565, 1.219798, 1.072601,  .919024,  .757839,  .587115,
3     $  .405026,  .209919,  .000000, 2.170812, 2.164198, 2.143122,
3     $ 2.108206, 2.059072, 1.995349, 1.917902, 1.826204, 1.721113,
3     $ 1.604316, 1.476192, 1.339462, 1.196371, 1.047303,  .893927,
3     $  .735197,  .568763,  .392173,  .203410,  .000000, 2.170811,
3     $ 2.164797, 2.143227, 2.108187, 2.058696, 1.993526, 1.915086,
3     $ 1.821011, 1.712356, 1.592315, 1.458899, 1.316856, 1.169561,
3     $ 1.016823,  .863034,  .706960,  .545518,  .375474,  .194900,
3     $  .000000, 2.170809, 2.164094, 2.142888, 2.107423, 2.057178,
3     $ 1.991610, 1.911075, 1.814909, 1.703567, 1.578141, 1.439553,
3     $ 1.291027, 1.136420,  .979244,  .823818,  .670430,  .515493,
3     $  .354935,  .184513,  .000000, 2.170807, 2.164585, 2.142972,
3     $ 2.107393, 2.056834, 1.990022, 1.908513, 1.810066, 1.695079,
3     $ 1.565655, 1.420163, 1.263374, 1.100096,  .934038,  .775150,
3     $  .624343,  .476731,  .326596,  .170005,  .000000/
3C
3      DATA T4B4/ 2.170805, 2.164616, 2.142908, 2.107137, 2.056178,
3     $ 1.988573, 1.905844, 1.805380, 1.687196, 1.553012, 1.400355,
3     $ 1.233503, 1.057230,  .878645,  .712617,  .563897,  .426092,
3     $  .290954,  .151878,  .000000, 2.170804, 2.163904, 2.142599,
3     $ 2.106497, 2.054970, 1.987269, 1.902875, 1.800825, 1.680286,
3     $ 1.540537, 1.381154, 1.202803, 1.008545,  .811488,  .629457,
3     $  .482260,  .359282,  .245319,  .128858,  .000000, 2.170802,
3     $ 2.164764, 2.142853, 2.106823, 2.055320, 1.986490, 1.901954,
3     $ 1.798338, 1.674820, 1.532175, 1.365132, 1.175784,  .959747,
3     $  .729965,  .526280,  .377719,  .269795,  .181745,  .096658,
3     $  .000000, 2.170800, 2.164388, 2.142693, 2.106501, 2.054723,
3     $ 1.985861, 1.900494, 1.796024, 1.671037, 1.524901, 1.352314,
3     $ 1.151884,  .913571,  .639924,  .368356,  .220849,  .155262,
3     $  .105409,  .057354,  .000000, 2.170798, 2.163829, 2.142488,
3     $ 2.106133, 2.054137, 1.985547, 1.899508, 1.794943, 1.668884,
3     $ 1.521450, 1.346740, 1.128583,  .897988,  .572877,  .099774,
3     $ -.018436,  .031183,  .002476, -.000457,  .000000/
3C
3C    INTERPOLATE NUMERICAL SOLUTION BY QUADRATICS
3C
3     CALL QUADRD(X,Y,TABLE,GRID,GRID,NGRID,NGRID,NGRDD,NGRDD,DERUSL)
3C
3     TRUE = DERUSL(6)
3C
3     RETURN
3     END
3     FUNCTION D(X)
3     D = 0.
3     IF (X .NE. 0.) D=1./X
3     RETURN
3     END
3     FUNCTION C(X)
3     C = 0.
3     IF (X .NE. 0.) C=1./X**2
```

```
      RETURN
      END
      FUNCTION A(X)
      A = 0.
      IF( X .LE. &A) A=1.
      RETURN
      END
      FUNCTION B(X)
      B = 1.
      IF( X .LE. &A) B=0.
      RETURN
      END
```

```
*EOR
************
* MACRO  52 *
************
*         2000000200020
1         TWO DIMENSIONS $ HOMOGENEOUS
1         R(X,Y)UXXS + R(X,Y)UYYS + R1(X,Y)UXS +
1.        R2(X,Y)UYS - (&A)US = 0.0
2         MIXED
          X=0. , MIXED = (1.)U + (-1.)UX = 1.
          X=1. , MIXED = (1.)U + ( 1.)UX = 1.
          Y=0. , MIXED = (1.)U + (-1.)UY = 1.
          Y=1. , MIXED = (1.)U + ( 1.)UY = 1.
3     FUNCTION TRUE(X,Y)
C
C     ***********************************************************
C     *                                                         *
C     *                  MACRO 52 PARAMETERS                    *
C     *                                                         *
C     ***********************************************************
C     *                                                         *
C     *                        A  I  B                          *
C     *                       ------I-----                      *
C     *                         2  I  1                         *
C     *                            I                            *
C     *                         4  I  2                         *
C     *                            I                            *
C     *                        49  I  3                         *
C     *                                                         *
C     ***********************************************************
C
3     REAL DERUSL(6), GRID(20), TABLE(20,20),
3    $     T1B1(100), T1B2(100), T1B3(100), T1B4(100),
3    $     T2B1(100), T2B2(100), T2B3(100), T2B4(100),
3    $     T3B1(100), T3B2(100), T3B3(100), T3B4(100)
3     EQUIVALENCE (TABLE(1, 1) , T&B1(1)),
3    $            (TABLE(1, 6) , T&B2(1)),
3    $            (TABLE(1,11) , T&B3(1)),
3    $            (TABLE(1,16) , T&B4(1))
3     DATA NGRID, LGRID, GRID /20, 20, 0.0000000, 0.0526316,
3    $0.1052632, 0.1578947, 0.2105263, 0.2631579, 0.3157895,
3    $0.3684211, 0.4210526, 0.4736842, 0.5263158, 0.5789474,
3    $0.6315790, 0.6842105, 0.7368421, 0.7894737, 0.8421053,
3    $0.8947368, 0.9473684, 1.0000000/
C
C     APPROXIMATE SOLUTION OF LINEARIZED PROBLEM USING
C     PS-01 COLLOCATION (3 X 3 GRID)
C
3     DATA T1B1/-2.266891,-2.477411,-2.674875,-2.833537,-3.100260,
3    $-3.319504,-3.508245,-3.741104,-3.886499,-4.106518,-4.247266,
3    $-4.389371,-4.415997,-4.402183,-4.402111,-4.321443,-4.193857,
3    $-4.099550,-3.815720,-3.580330,-2.477411,-2.699337,-2.877542,
3    $-3.007772,-3.226190,-3.537712,-3.783302,-4.005670,-4.208767,
3    $-4.373000,-4.537200,-4.642505,-4.716380,-4.734307,-4.703236,
3    $-4.610353,-4.481900,-4.303810,-4.095019,-3.853016,-2.674675,
3    $-2.877612,-3.007101,-3.190554,-3.370331,-3.514999,-4.056496,
3    $-4.223437,-4.503494,-4.333333,-4.351172,-4.333323,-5.041497,
3    $-4.[illegible],-5.[illegible],-4.[illegible],-4.[illegible],-4.607137,-4.376274,
3    $-4.[illegible],-3.[illegible],-3.[illegible],-3.[illegible],-3.574302,-3.829377,
3    $-4.[illegible],-4.[illegible],-4.[illegible],-5.013332,-5.165777,
3    $-5.[illegible],-5.[illegible],-5.[illegible],-5.206333,-5.165442,
3    $-4.[illegible],-4.[illegible],-4.[illegible],-3.383173,-3.570675,
3    $-4.[illegible],-4.[illegible],-4.[illegible],-4.301373,-5.145344,
```

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3     $-5.359355,-5.538342,-5.673801,-5.757983,-5.783297,-5.750050,
3     $-5.652781,-5.494061,-5.285534,-5.026931,-4.735006/
3C
3      DATA T1B2/-3.319588,-3.557704,-3.814992,-4.087607,-4.371136,
3     $-4.659276,-4.945238,-5.221158,-5.478167,-5.707150,-5.898626,
3     $-6.043963,-6.134685,-6.164839,-6.130549,-6.029687,-5.865297,
3     $-5.642867,-5.371350,-5.064797,-3.536238,-3.786231,-4.056465,
3     $-4.343003,-4.641409,-4.945226,-5.247200,-5.539237,-5.811945,
3     $-6.055999,-6.260448,-6.416966,-6.516584,-6.550719,-6.518987,
3     $-6.415240,-6.242165,-6.012213,-5.725112,-5.399797,-3.744091,
3     $-4.005609,-4.288457,-4.528698,-4.901821,-5.221142,-5.539232,
3     $-5.847568,-6.136268,-6.395407,-6.613634,-6.781725,-6.890016,
3     $-6.929951,-6.899629,-6.793538,-6.614476,-6.373268,-6.072755,
3     $-5.731579,-3.936482,-4.208748,-4.503405,-4.816681,-5.143926,
3     $-5.478153,-5.811935,-6.136262,-6.440792,-6.714804,-6.947114,
3     $-7.126991,-7.243976,-7.290679,-7.261707,-7.153986,-6.970878,
3     $-6.717139,-6.404841,-6.049837,-4.106496,-4.388683,-4.693715,
3     $-5.018842,-5.359151,-5.707111,-6.055849,-6.395290,-6.714795,
3     $-7.004259,-7.249851,-7.441904,-7.569564,-7.621950,-7.597948,
3     $-7.489698,-7.299751,-7.041875,-6.715955,-6.343822/
3C
3      DATA T1B3/-4.247239,-4.537166,-4.851413,-5.186694,-5.538230,
3     $-5.898587,-6.260363,-6.613568,-6.947099,-7.249844,-7.508522,
3     $-7.711945,-7.848491,-7.908426,-7.887137,-7.779087,-7.587039,
3     $-7.319862,-6.984879,-6.601692,-4.352339,-4.648452,-4.969551,
3     $-5.312937,-5.673655,-6.043918,-6.416831,-6.781617,-7.126969,
3     $-7.441813,-7.711902,-7.925710,-8.071085,-8.137910,-8.120494,
3     $-8.013640,-7.820049,-7.547003,-7.204432,-6.811596,-4.415631,
3     $-4.716214,-5.041344,-5.390302,-5.757608,-6.134592,-6.516233,
3     $-6.889737,-7.243942,-7.569313,-7.848370,-8.071077,-8.225159,
3     $-8.297419,-8.285615,-8.180966,-7.985598,-7.712056,-7.363217,
3     $-6.961731,-4.433248,-4.734183,-5.061680,-5.412922,-5.783169,
3     $-6.164781,-6.550599,-6.929851,-7.290843,-7.621865,-7.908378,
3     $-8.137895,-8.297412,-8.376323,-8.367628,-8.265814,-8.073288,
3     $-7.796413,-7.445483,-7.043072,-4.402068,-4.702805,-5.028218,
3     $-5.379106,-5.749601,-6.130437,-6.518531,-6.899265,-7.261659,
3     $-7.597524,-7.886929,-8.120401,-8.285385,-8.367567,-8.363758,
3     $-8.265618,-8.074885,-7.801117,-7.451618,-7.047560/
3C
3      DATA T1B4/-4.321397,-4.617910,-4.938938,-5.285676,-5.652307,
3     $-6.029568,-6.414758,-6.793152,-7.153933,-7.489248,-7.778864,
3     $-8.013537,-8.180719,-8.265745,-8.265612,-8.171591,-7.985176,
3     $-7.716002,-7.370826,-6.970863,-4.193810,-4.481816,-4.796561,
3     $-5.135366,-5.493972,-5.865238,-6.242077,-6.614398,-6.970830,
3     $-7.299675,-7.586987,-7.820012,-7.985555,-8.073266,-8.074875,
3     $-7.985171,-7.806041,-7.541693,-7.205032,-6.814478,-4.022610,
3     $-4.303958,-4.606906,-4.936086,-5.284853,-5.642713,-6.011492,
3     $-6.372695,-6.717078,-7.041131,-7.319499,-7.546800,-7.711523,
3     $-7.796268,-7.800902,-7.715782,-7.541672,-7.287505,-6.960953,
3     $-6.581414,-3.815741,-4.084604,-4.376095,-4.691890,-5.026501,
3     $-5.371237,-5.724659,-6.072391,-6.404786,-6.715491,-6.984646,
3     $-7.204297,-7.362887,-7.446387,-7.451482,-7.370689,-7.205016,
3     $-6.960951,-6.647758,-6.283551,-3.583633,-3.837966,-4.116637,
3     $-4.416881,-4.734953,-5.064746,-5.399747,-5.731531,-6.049792,
3     $-6.343780,-6.601654,-6.811564,-6.961704,-7.043052,-7.047545,
3     $-6.970853,-6.814473,-6.581412,-6.283551,-5.937218/
3C
3      DATA T2B1/  .478933,  .448750,  .413085,  .372015,  .325851,
3     $  .275479,  .221334,  .166543,  .111361,  .058370,  .009911,
3     $ -.031690, -.064102, -.085586, -.094622, -.090432, -.073359,
3     $ -.043993, -.004235,  .043099,  .448750,  .417191,  .379138,
3     $  .335726,  .286911,  .233105,  .176590,  .117718,  .058754,
3     $  .002353, -.048907, -.093287, -.127655, -.150734, -.160524,
3     $ -.156153, -.138052, -.107269, -.065052, -.014599,  .413085,
3     $  .379139,  .338633,  .292047,  .239587,  .182074,  .121051,
3     $  .057764, -.005507, -.066099, -.121836, -.169745, -.207118,
3     $ -.232144, -.242898, -.238474, -.219272, -.186125, -.141026,
3     $ -.087125,  .372015,  .335722,  .292045,  .241840,  .185165,
3     $  .122677,  .056652, -.012216, -.081321, -.147148, -.208247,
3     $ -.260841, -.301842, -.329721, -.341994, -.337682, -.317244,
3     $ -.281823, -.233080, -.174720,  .325853,  .286905,  .239585,
3     $  .185165,  .123550,  .055251, -.016754, -.092230, -.168236,
3     $ -.240467, -.307984, -.366265, -.411801, -.443187, -.457441,
3     $ -.453449, -.431711, -.393647, -.340704, -.277178/
3C
3      DATA T2B2/  .275481,  .233107,  .182076,  .122678,  .055252,
```

```
3     $ -.019057, -.098575, -.181433, -.264749, -.345255, -.419762,
3     $ -.484474, -.535735, -.570941, -.587490, -.584053, -.561048,
3     $ -.519418, -.462044, -.393094,  .221888,  .176589,  .121053,
3     $  .056659, -.016745, -.093573, -.165203, -.276569, -.369096,
3     $ -.457380, -.540624, -.613044, -.670245, -.710644, -.730248,
3     $ -.727640, -.703371, -.659145, -.598471, -.520838,  .166548,
3     $  .117719,  .057768, -.012209, -.092221, -.181430, -.276567,
3     $ -.376376, -.478604, -.576497, -.668670, -.749294, -.813604,
3     $ -.859284, -.882231, -.880751, -.855335, -.807546, -.739671,
3     $ -.657482,  .111367,  .058760, -.005501, -.081314, -.168230,
3     $ -.264744, -.369092, -.478602, -.589538, -.698110, -.799441,
3     $ -.888575, -.960848,-1.012034,-1.038636,-1.038581,-1.012203,
3     $ -.950482, -.887457, -.798765,  .058377,  .002879, -.066084,
3     $ -.147116, -.240422, -.345242, -.457338, -.576464, -.698107,
3     $ -.815491, -.927263,-1.025851,-1.105371,-1.163352,-1.194275,
3     $-1.195935,-1.168805,-1.114903,-1.036203, -.940054/
3C
3      DATA T2B3/  .009920, -.048889, -.121823, -.208226, -.307957,
3     $ -.419750, -.540598, -.658649, -.799436, -.927260,-1.048289,
3     $-1.155702,-1.243353,-1.307283,-1.342371,-1.345980,-1.318398,
3     $-1.261056,-1.177632,-1.075312, -.031679, -.093256, -.169727,
3     $ -.260810, -.355224, -.484457, -.613001, -.749258, -.888666,
3     $-1.025829,-1.155637,-1.271499,-1.366755,-1.436631,-1.475942,
3     $-1.481651,-1.453930,-1.394011,-1.306258,-1.198151, -.064089,
3     $ -.127585, -.207084, -.301774, -.411703, -.535708, -.670135,
3     $ -.813515, -.960835,-1.105281,-1.243309,-1.366751,-1.468469,
3     $-1.544190,-1.587655,-1.595538,-1.567957,-1.506854,-1.415280,
3     $-1.301859, -.085572, -.150704, -.232123, -.329591, -.443149,
3     $ -.570920, -.710603, -.859249,-1.012019,-1.163319,-1.307269,
3     $-1.436825,-1.544187,-1.624282,-1.671116,-1.681080,-1.654075,
3     $-1.591147,-1.497287,-1.380616, -.094606, -.160425, -.242852,
3     $ -.341905, -.457313, -.587453, -.730096, -.882109,-1.038616,
3     $-1.194117,-1.342292,-1.475904,-1.587562,-1.671092,-1.720865,
3     $-1.732707,-1.706363,-1.643403,-1.548036,-1.428959/
3C
3      DATA T2B4/ -.090415, -.155055, -.238425, -.337588, -.453314,
3     $ -.584014, -.727479, -.880622,-1.038559,-1.195767,-1.345895,
3     $-1.481618,-1.595438,-1.681051,-1.732704,-1.746057,-1.720747,
3     $-1.658304,-1.562861,-1.443236, -.073341, -.138027, -.219250,
3     $ -.317218, -.431681, -.561025, -.703338, -.855305,-1.012183,
3     $-1.168773,-1.318375,-1.453913,-1.567948,-1.654065,-1.706357,
3     $-1.720745,-1.695789,-1.635080,-1.541078,-1.422911, -.043975,
3     $ -.107112, -.185057, -.281689, -.393448, -.519368, -.658904,
3     $ -.807352, -.950437,-1.114624,-1.260919,-1.393928,-1.506649,
3     $-1.591087,-1.643312,-1.658212,-1.635070,-1.575540,-1.483884,
3     $-1.368325, -.004278, -.064950, -.140978, -.232992, -.340577,
3     $ -.462005, -.598317, -.738546, -.887434,-1.035027,-1.177542,
3     $-1.306202,-1.415145,-1.497245,-1.547978,-1.562803,-1.541071,
3     $-1.483833,-1.385735,-1.234420,  .043116, -.014531, -.087106,
3     $ -.174700, -.277158, -.393073, -.520818, -.657461, -.798745,
3     $ -.940035,-1.075294,-1.198135,-1.301856,-1.380506,-1.428962,
3     $-1.443231,-1.422908,-1.368325,-1.284419,-1.178408/
3C
3      DATA T3B1/  .126993,  .075205,  .017325, -.038118, -.080112,
3     $ -.097453, -.079581, -.024216,  .060504,  .162810,  .261036,
3     $  .332932,  .359865,  .342591,  .287119,  .212625,  .143734,
3     $  .103549,  .100115,  .130245,  .075205,  .020373, -.042050,
3     $ -.101832, -.147439, -.167279, -.149574, -.091639, -.002502,
3     $  .103916,  .206778,  .280741,  .305583,  .283781,  .221892,
3     $  .140192,  .065262,  .022950,  .020287,  .053445,  .017325,
3     $ -.042050, -.110341, -.176784, -.228282, -.251777, -.234698,
3     $ -.174545, -.081441,  .029325,  .134458,  .205991,  .223217,
3     $  .189114,  .113010,  .018583, -.064518, -.109534, -.109166,
3     $ -.070020, -.033116, -.101831, -.176773, -.250301, -.308100,
3     $ -.338122, -.319865, -.253733, -.159235, -.044530,  .060156,
3     $  .125920,  .130340,  .077332, -.017064, -.127447, -.221919,
3     $ -.268508, -.283312, -.216510, -.080108, -.147420, -.228263,
3     $ -.308093, -.371130, -.402143, -.384584, -.317027, -.213899,
3     $ -.095518,  .007775,  .064722,  .051930, -.023335, -.138876,
3     $ -.235517, -.339370, -.415238, -.403400, -.343335/
3C
3      DATA T3B2/ -.087453, -.167257, -.251763, -.333117, -.402140,
3     $ -.432453, -.410533, -.355565, -.224380, -.101519, -.000451,
3     $  .045313,  .012973, -.033525, -.219719, -.357633, -.461898,
3     $ -.501704, -.430710, -.419235, -.379575, -.199416, -.234638,
3     $ -.315502, -.334472, -.410570, -.381537, -.295745, -.174111,
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3     $ -.046230,  .053343,  .089557,  .040849, -.074972, -.221806,
3     $ -.359540, -.455223, -.482402, -.447939, -.331213, -.024211,
3     $ -.091514, -.174497, -.255573, -.319937, -.335648, -.295742,
3     $ -.197406, -.065352,  .087300,  .163109,  .187597,  .122775,
3     $ -.004551, -.150943, -.272313, -.341646, -.340935, -.288626,
3     $ -.220243,  .060503, -.002494, -.081435, -.159287, -.213890,
3     $ -.224373, -.174106, -.065350,  .073450,  .206813,  .293471,
3     $  .301633,  .219464,  .085174, -.048721, -.136533, -.160111,
3     $ -.115001, -.036935,  .032232,  .162811,  .104116,  .029897,
3     $ -.044440, -.065479, -.101490, -.046247,  .067285,  .206815,
3     $  .331725,  .400547,  .385789,  .285505,  .145475,  .028720,
3     $ -.009277,  .033593,  .130024,  .248837,  .327546/
3C
3      DATA T333/  .261032,  .206867,  .134488,  .060196,  .007841,
3     $ -.000435,  .053339,  .163107,  .293475,  .400549,  .443089,
3     $  .397749,  .269392,  .120930,  .028570,  .046584,  .161454,
3     $  .333233,  .495164,  .581070,  .332953,  .280758,  .205994,
3     $  .125918,  .064725,  .045324,  .089512,  .187555,  .301687,
3     $  .386745,  .397728,  .315747,  .153868, -.011971, -.090161,
3     $ -.024029,  .158554,  .401369,  .614031,  .713694,  .359952,
3     $  .305744,  .223233,  .130337,  .051993,  .012984,  .040670,
3     $  .122335,  .219465,  .285367,  .269328,  .153868, -.041887,
3     $ -.237410, -.321575, -.230112,  .000162,  .291385,  .551835,
3     $  .675303,  .342575,  .283785,  .189109,  .077326, -.023385,
3     $ -.083522, -.075012, -.004580,  .085177,  .145441,  .120914,
3     $ -.011972, -.237410, -.458370, -.561218, -.473735, -.231550,
3     $  .084315,  .379555,  .515872,  .287103,  .221900,  .113007,
3     $ -.017075, -.138884, -.219716, -.221952, -.151058, -.048722,
3     $  .028594,  .028555, -.090070, -.321295, -.561147, -.693219,
3     $ -.841933, -.432564, -.115902,  .167791,  .309678/
3C
3      DATA T334/  .212612,  .140202,  .018682, -.127456, -.265623,
3     $ -.357632, -.359594, -.272436, -.136537, -.009309,  .046566,
3     $ -.023335, -.229817, -.473657, -.641928, -.650813, -.507641,
3     $ -.244456,  .008817,  .145796,  .143724,  .065254, -.064623,
3     $ -.221921, -.369367, -.461891, -.455236, -.341655, -.160116,
3     $  .033585,  .161442,  .158656,  .000188, -.231535, -.432552,
3     $ -.507633, -.443508, -.257927, -.054149,  .068162,  .103541,
3     $  .023083, -.109489, -.268428, -.415111, -.501757, -.482510,
3     $ -.341024, -.115011,  .129941,  .333186,  .401493,  .291788,
3     $  .094425, -.115535, -.244178, -.257895, -.136802,  .005410,
3     $  .097410,  .100109,  .020356, -.109138, -.263262, -.403320,
3     $ -.480591, -.448062, -.288581, -.035947,  .248778,  .496127,
3     $  .614100,  .552076,  .379730,  .167952,  .008997, -.054118,
3     $  .005418,  .104693,  .179123,  .130242,  .053441, -.070020,
3     $ -.216505, -.348829, -.419277, -.381208, -.220246,  .032221,
3     $  .327529,  .581051,  .713681,  .675303,  .515886,  .309701,
3     $  .145320,  .053182,  .097421,  .179127,  .247236/
3C
3C     INTERPOLATE NONLINEAR SOLUTION BY QUADRATICS
3C
3      CALL QUADRD(X,Y,TABLE,GRID,GRID,NGRID,NGRID,NGRDD,NGRDD,DERVSL)
3C
3      TRUE = DERVSL(G)
3C
3      RETURN
3      END
3      FUNCTION W(NDERV,X,Y)
3C
3      REAL DERVSL(6), GRID(9), TAB(9,9)
3      DATA NGRID, NGRDD, GRID /9, 9, 0., 0.125, 0.250,
3     $0.375, 0.500, 0.625, 0.750, 0.875, 1.00/
3C
3C     APPROXIMATE SOLUTION OF NONLINEAR PROBLEM FOR NONLINEAR
3C     COLLOCATION
3C
3      DATA  TAB/ -.849250,-1.033350,-1.342400,-1.591250,-1.813110,
3     $-1.078340,-2.044640,-1.975450,-1.789850,-1.362380,
3     $-1.548320,-1.933770,-2.183220,-2.377680,-2.458420,-2.382970,
3     $-2.103230,-1.342330,-1.942610,-1.973700,-2.303520,-2.599760,
3     $-2.824030,-2.026630,-2.843230,-2.523770,-1.591240,-1.933760,
3     $-2.303510,-2.377800,-3.022520,-3.283330,-3.420340,-3.346720,
3     $-3.001420,-1.810030,-2.183300,-2.593750,-3.022510,-3.418130,
3     $-3.733750,-3.387260,-3.831430,-3.454020,-1.973310,-2.377650,
3     $-2.824300,-3.290030,-3.732740,-4.022330,-4.252330,-4.239560,
3     $-3.837050,-2.044610,-2.453030,-2.926340,-3.420310,-3.897240,
```

```
3     G=1.332670,-4.523430,-4.434770,-4.071720,-1.975430,-2.382940,
3    G=2.340260,-3.343660,-3.331130,-4.223540,-4.434730,-4.461540,
3     G=1.168220,-1.731370,-2.109340,-2.528740,-3.001330,-3.454290,
3    G=3.837930,-4.071710,-4.058220,-3.983550/
3C
3     INTERPOLATE NONLINEAR SOLUTION BY QUADRATICS
3C
3     CALL QUADRD(X,Y,TAB,GRID,GRID,NGRID,NGRID,NGRDD,NGRDD,DERVSL)
3C
3     U = DERVSL(NDERV)
3C
3     RETURN
3     END
3     FUNCTION R(X,Y)
3     R = 11./(1. + 10.*W(6,X,Y))
3     RETURN
3     END
3     FUNCTION R1(X,Y)
3     R1 = -110./(1.+10.*W(6,X,Y))**2*W(4,X,Y)
3     RETURN
3     END
3     FUNCTION R2(X,Y)
3     R2 = -110./(1.+10.*W(6,X,Y))**2*W(5,X,Y)
3     RETURN
3     END
```

```
'EOR
*************
* MACRO  53 *
*************
*          2000021002000
1          TWO DIMENSIONS S CONSTANT COEFFICIENTS
1          UXX$ + UYY$ - (&A)U$ = F(X,Y)
2          DIRICHLET
2          X=0. , U=TRUE(X,Y)
2          X=1. , U=TRUE(X,Y)
2          Y=0. , U=TRUE(X,Y)
2          Y=1. , U=TRUE(X,Y)
3     FUNCTION TRUE(X,Y)
3     TRUE = COS(&B*Y)+SIN(&B*(X-Y))
3     RETURN
3     END
3     FUNCTION F(X,Y)
3     BXMY = &B*(X-Y)
3     B2 = (&B)*(&B)
3     UXX = -B2*SIN(BXMY)
3     U = COS(&B*Y)+SIN(BXMY)
3     UYY = -B2*U
3     F = UXX + UYY - (&A)*U
3     RETURN
3     END
```

```
'EOR
*************
* MACRO  54 *
*************
*          2000000002000
1          TWO DIMENSIONS
1          (1.+X*X)UXX$ + (1.+A(Y)**2)UYY$ + (2.*X)UX$ +
1.         (15.*Y*A(Y))UY$ - (1.+(8.*Y-X-4.)**2)U$ = F(X,Y)
2          DIRICHLET
2          X=0. , U=TRUE(X,Y)
2          X=1. , U=TRUE(X,Y)
2          Y=0. , U=TRUE(X,Y)
2          Y=1. , U=TRUE(X,Y)
3     FUNCTION TRUE(X,Y)
3     A0Y=A(Y)
3     R = AMAX1(0.,(3.-X/A0Y)**3)
3     G = AMAX1(0.,X-A0Y)
3     T = 0.
3     IF (G .GE. .02) T = EXP(-R/G)
3        = 2.33*(X-A0Y)**2/A0Y**3
3     H    = 1./(1. + (8.*Y-X-4.)**2)
3     TRUE = G*(1.-T) * H
3     RETURN
3     END
```

```
3      FUNCTION A(Y)
3      A = 4.*Y*Y + (&A)
3      RETURN
3      END
3      FUNCTION F(X,Y)
3      A0Y = A(Y)
3      A1Y = 8.*Y
3      A2Y = 8.
3      GN  = X*(X-A0Y)**2
3      GNX = 3.*X**2 - 4.*X*A0Y + A0Y**2
3      GNXX= 6.*X - 4.*A0Y
3      GNY = 2.*X*(A0Y-X)*A1Y
3      GNYY= 2.*X*A1Y**2 + 2.*X*(A0Y-X)*A2Y
3      GD  = A0Y**3
3      GDY = 3.*A0Y**2*A1Y
3      GDYY= 3.*(2.*A0Y*A1Y**2 + A0Y**2*A2Y)
3      G   = 2.25*GN/GD
3      GX  = 2.25*GNX/GD
3      GXX = 2.25*GNXX/GD
3      GY  = 2.25*(GD*GNY-GN*GDY)/GD**2
3      GYY =2.25*((GD*GNYY-GN*GDYY)/GD**2
3     $     + 2.*(GN*GDY-GD*GNY)*GDY/GD**3)
3      HD  = 1. + (8.*Y-X-4.)**2
3      HDX = -2.*(8.*Y-X-4.)
3      HDXX= 2.
3      HDY = 16.*(8.*Y-X-4.)
3      HDYY= 128.
3      H   = 1./HD
3      HX  = -HDX/HD**2
3      HXX = (-HDXX +2.*HDX*HDX/HD)/(HD*HD)
3      HY  = -HDY/HD**2
3      HYY =(-HDYY +2.*HDY*HDY/HD)/(HD*HD)
3      T   = 0.
3      TX  = 0.
3      TXX = 0.
3      TY  = 0.
3      TYY = 0.
3      S   = AMAX1(0.,X-A0Y)
3      IF (S .LT. .02) GO TO 10
3      R   = AMAX1(0.,(3.-X/A0Y)**3)
3      T   = 1.0
3      IF (R .EQ. 0.0) GO TO 10
3      S2  = S*S
3      S3  = S2*S
3      SX  = 1.
3      SXX = 0.
3      SY  = -A1Y
3      SYY = -A2Y
3      RX  =  -3.*(3.-X/A0Y)**2/A0Y
3      RXX =  6.*(3.-X/A0Y)/A0Y**2
3      RY  =  3.*(3.-X/A0Y)**2*X*A1Y/A0Y**2
3      RYY =  6.*(3.-X/A0Y)*(X*A1Y/A0Y**2)**2 +
3     $      3.*X*(3.-X/A0Y)**2*(A2Y-2.*A1Y**2/A0Y)/A0Y**2
3      Q   = R/S
3      QX  = (RX-Q)/S
3      QXX = RXX/S + 2.*(R-S*RX)/S3
3      QY  = (RY-Q*SY)/S
3      QYY = (S*RYY-R*SYY)/S2 + 2.*(R*SY-S*RY)*SY/S3
3      T   = EXP(-Q)
3      TX  = -QX*T
3      TXX = (QX*QX - QXX)*T
3      TY  = -QY*T
3      TYY = (QY*QY - QYY)*T
3   10 U   = G*(1.-T) + H
3      UX  = GX*(1.-T) - G*TX + HX
3      UXX = GXX*(1.-T) -2.*GX*TX - G*TXX + HXX
3      UY  = GY*(1.-T) - G*TY + HY
3      UYY = GYY*(1.-T) -2.*GY*TY - G*TYY + HYY
3      F1  = (1.*X)*UXX
3      F2  = 2.*X*UX
3      F3  = (1.*A0Y**2)*UYY
3      F4  = 2.*A0Y*A1Y*UY
3      F5  = HD*U
3      F   = F1 + F2 + F3 + F4 - F5
3      RETURN
3      END
```

```
3     FUNCTION CDXU(X)
3     CDXU = 2.*X
3     RETURN
3     END
3     FUNCTION CDYU(Y)
3     CDYU = 16.*Y*A(Y)
3     RETURN
3     END
------------------------------------------------------------------------
'EOR
*************
* MACRO  55 *
*************
*         2022021200220
1         TWO DIMENSIONS $ CONSTANT COEFFICIENTS $ HOMOGENEOUS
1.        POISSON $ LAPLACE
1         UXX$ + UYY$ = 0.
2         MIXED
2         X=0. , UX = 0.
2         X=6. , U  = F(Y)
2         Y=0. , MIXED = (A(X))U + (B(X))UY = G(X)
2         Y=1. , MIXED = (C(X))U + (D(X))UY = H(X)
3     FUNCTION TRUE(X,Y)
3C
3C    ********************************************************
3C    *                                                      *
3C    *                 MACRO 55 PARAMETERS                  *
3C    *                                                      *
3C    ********************************************************
3C    *                                                      *
3C    *                A  I  B  I  C  I  D                   *
3C    *               ----I-----I-----I-----                 *
3C    *                1  I  3  I  1  I  1                   *
3C    *                   I     I     I                      *
3C    *                3  I  2  I  1  I  2                   *
3C    *                   I     I     I                      *
3C    *                1  I  3  I  2  I  3                   *
3C    *                   I     I     I                      *
3C    *                6  I  2  I  2  I  4                   *
3C    *                                                      *
3C    ********************************************************
3C
3      REAL DERVSL(6), TABLE(20,20), GRIDX(20), GRIDY(20),
3     $     T1B1(100), T1B2(100), T1B3(100), T1B4(100),
3     $     T2B1(100), T2B2(100), T2B3(100), T2B4(100),
3     $     T3B1(100), T3B2(100), T3B3(100), T3B4(100),
3     $     T4B1(100), T4B2(100), T4B3(100), T4B4(100)
3      EQUIVALENCE (TABLE(1, 1) , T&DB1(1)),
3     $            (TABLE(1, 6) , T&DB2(1)),
3     $            (TABLE(1,11) , T&DB3(1)),
3     $            (TABLE(1,16) , T&DB4(1))
3      DATA NGRID, NGRDD/20, 20/
3      DATA GRIDX/0.0000000, 0.3157895, 0.6315789, 0.9473684,
3     $1.2631579, 1.5789474, 1.8947368, 2.2105263, 2.5263158,
3     $2.8421053, 3.1578947, 3.4736842, 3.7894737, 4.1052632,
3     $4.4210526, 4.7368421, 5.0526316, 5.3684211, 5.6842105,
3     $6.0000000/
3      DATA GRIDY/0.0000000, 0.0526316, 0.1052632, 0.1578947,
3     $0.2105263, 0.2631579, 0.3157895, 0.3684211, 0.4210526,
3     $0.4736842, 0.5263158, 0.5789474, 0.6315789, 0.6842105,
3     $0.7368421, 0.7894737, 0.8421053, 0.8947368, 0.9473684,
3     $1.0000000/
3C
3C     APPROXIMATE SOLUTION OF PROBLEM USING
3C     P3-C1 COLLOCATION (8 X 8 GRID)
3C
3      DATA T1B1/ 1.000000,  1.000667,  .983821,  .420922,  .084411,
3     $  .035378, -.003356, -.015701, -.009375, -.002313,  .008574,
3     $  .024493,  .047173,  .081810,  .135691,  .224512,  .335447,
3     $  .574550,  .825183,  .193533,  .893518,  .901037,  .853587,
3     $  .393040,  .099743,  .037577,  .000429, -.012505, -.007912,
3     $ -.001690,  .009149,  .024773,  .047198,  .031694,  .135738,
3     $  .222411,  .338273,  .537131,  .801939,  .359473,  .853182,
3     $  .355271,  .773375,  .400049,  .123393,  .043842,  .006698,
3     $ -.007840, -.006273, -.000533,  .003540,  .024355,  .046719,
3     $  .031055,  .134750,  .217438,  .342537,  .549524,  .762227,
```

```
3     $  .679519,  .801162,  .300456,  .709509,  .387042,  .144879,
3     $  .052702,  .011476, -.004313, -.004698,  .000392,  .010016,
3     $  .024734,  .043114,  .079308,  .132392,  .213548,  .342696,
3     $  .535720,  .752668,  .931028,  .744500,  .736089,  .643791,
3     $  .333742,  .143713,  .056916,  .014898, -.001739, -.003249,
3     $  .091201,  .010233,  .024401,  .045225,  .078218,  .130098,
3     $  .209415,  .339227,  .524903,  .760932, 1.120886/
3C
3      DATA T132/  .691121,  .676536,  .585052,  .351887,  .159677,
3     $  .051201,  .017742,  .000503, -.001946,  .001772,  .010264,
3     $  .023329,  .043883,  .075958,  .126165,  .203839,  .333255,
3     $  .514169,  .773032, 1.279803,  .636654,  .619692,  .531081,
3     $  .327509,  .154833,  .062477,  .019806,  .002285, -.000822,
3     $  .002375,  .010237,  .023138,  .042455,  .073257,  .121987,
3     $  .197891,  .324684,  .504710,  .787854, 1.394511,  .583002,
3     $  .553305,  .480451,  .305097,  .151547,  .063126,  .021175,
3     $  .003532,  .000118,  .002759,  .010037,  .022211,  .040570,
3     $  .070012,  .116645,  .190069,  .313769,  .492449,  .798221,
3     $ 1.474932,  .530252,  .509554,  .432747,  .283433,  .148548,
3     $  .032931,  .021393,  .004730,  .000874,  .002973,  .009690,
3     $  .021030,  .038318,  .066273,  .110358,  .180840,  .300630,
3     $  .477234,  .801975, 1.525152,  .478274,  .458862,  .388035,
3     $  .256507,  .133461,  .060391,  .021829,  .005311,  .001444,
3     $  .003203,  .009234,  .018871,  .033070,  .052150,  .104069,
3     $  .171114,  .285418,  .481522,  .798957, 1.548161/
3C
3      DATA T133/  .427264,  .408292,  .344767,  .232561,  .127787,
3     $  .057565,  .021485,  .005803,  .001848,  .003221,  .008719,
3     $  .018410,  .033282,  .057531,  .096368,  .159404,  .268094,
3     $  .439280,  .784433, 1.548305,  .377170,  .359428,  .303185,
3     $  .207574,  .116843,  .053516,  .020433,  .005902,  .002086,
3     $  .003148,  .008054,  .016821,  .030347,  .052530,  .088189,
3     $  .148711,  .248816,  .413428,  .759381, 1.528924,  .327949,
3     $  .312441,  .263089,  .180935,  .102526,  .043458,  .018712,
3     $  .005576,  .002171,  .003015,  .007308,  .015139,  .027323,
3     $  .047192,  .079746,  .133263,  .227699,  .384181,  .723145,
3     $ 1.493296,  .279529,  .265585,  .223708,  .156100,  .090615,
3     $  .043055,  .017082,  .005420,  .002131,  .002752,  .006455,
3     $  .013245,  .023834,  .041451,  .070033,  .117935,  .204819,
3     $  .347194,  .672061, 1.444286,  .231817,  .220165,  .185339,
3     $  .129589,  .075490,  .036645,  .014486,  .004591,  .001962,
3     $  .002426,  .005529,  .011323,  .020400,  .035466,  .060449,
3     $  .102122,  .180487,  .307418,  .507928, 1.384541/
3C
3      DATA T134/  .184712,  .175369,  .147577,  .103505,  .060616,
3     $  .028854,  .011863,  .003814,  .001697,  .002036,  .004537,
3     $  .009280,  .016995,  .029188,  .050189,  .084775,  .154888,
3     $  .251757,  .527022, 1.316522,  .138097,  .130873,  .110217,
3     $  .078277,  .043749,  .022887,  .009412,  .003214,  .001360,
3     $  .001588,  .003485,  .007127,  .012990,  .022632,  .039263,
3     $  .065446,  .123393,  .210137,  .426129, 1.242253,  .091856,
3     $  .037003,  .073283,  .051189,  .029749,  .015170,  .005793,
3     $  .001745,  .000943,  .001077,  .002372,  .005048,  .008746,
3     $  .015933,  .028951,  .044983,  .101410,  .155508,  .303585,
3     $ 1.163707,  .045835,  .043438,  .036535,  .025492,  .014754,
3     $  .007306,  .002359,  .000843,  .000503,  .000555,  .001222,
3     $  .002924,  .004365,  .008967,  .018440,  .021335,  .074371,
3     $  .068313,  .153643, 1.082479,  .000000,  .000000,  .000000,
3     $  .000001,  .000000,  .000002,  .000005, -.000004,  .000052,
3     $  .000008,  .000015,  .000909, -.000385,  .001713,  .008657,
3     $ -.006036,  .047770,  .042140, -.031332, 1.000000/
3C
3      DATA T231/  .037037,  .037036,  .037042,  .037095,  .037003,
3     $  .037222,  .037454,  .038587,  .041350,  .037931,  .017225,
3     $  .017017,  .033075,  .057847,  .114654,  .191354,  .286786,
3     $  .402011,  .707037,  .171054,  .035093,  .035179,  .035128,
3     $  .035185,  .035190,  .035283,  .035523,  .035414,  .038499,
3     $  .035824,  .018012,  .010313,  .033231,  .063133,  .114094,
3     $  .188342,  .333247,  .488870,  .537150,  .303091,  .033143,
3     $  .033174,  .033192,  .033185,  .033217,  .033325,  .033563,
3     $  .033700,  .035709,  .022332,  .019535,  .020385,  .038405,
3     $  .037717,  .114183,  .185424,  .282054,  .470592,  .653094,
3     $  .532350,  .031103,  .031255,  .031213,  .031243,  .031292,
3     $  .031373,  .031304,  .031303,  .033217,  .033756,  .019391,
3     $  .021323,  .033107,  .033033,  .113033,  .182111,  .293102,
3     $  .453773,  .644353,  .427550,  .033245,  .033300,  .029224,
```

```
3     $ .023312, .020072, .020123, .020575, .030026, .030765,
3     $ .020070, .019973, .022594, .027737, .055302, .110377,
3     $ .178303, .300121, .412535  .059001, .330370/
3C
3      DATA T232/ .027303, .027303, .027310, .027333, .027379,
3     $ .027433, .027350, .023010, .020111, .025331, .019531,
3     $ .022213, .022257, .050227, .107105, .173905, .283080,
3     $ .443344, .662378, 1.055371, .025317, .025399, .025375,
3     $ .025406, .025455, .025511, .025703, .026052, .026150,
3     $ .023533, .018086, .022110, .035224, .031730, .103632,
3     $ .163793, .277771, .432259, .675093, 1.195133, .023393,
3     $ .023479, .023422, .023451, .023505, .023553, .023755,
3     $ .024023, .023955, .021694, .018047, .021558, .034567,
3     $ .053133, .099153, .162231, .269153, .421771, .683983,
3     $ 1.234135, .021443, .021451, .021459, .021479, .021518,
3     $ .021590, .021747, .021976, .021221, .019735, .017377,
3     $ .020710, .032343, .056105, .033354, .154379, .257231,
3     $ .408752, .637215, 1.307151, .019433, .019543, .019524,
3     $ .019552, .019502, .019537, .019311, .019331, .019735,
3     $ .010043, .013316, .019532, .031039, .052592, .088555,
3     $ .145107, .244231, .365311, .934540, 1.323871/
3C
3      DATA T233/ .017543, .017571, .017565, .017587, .017628,
3     $ .017574, .017313, .017944, .017665, .018247, .015073,
3     $ .018374, .033301, .043554, .022037, .133129, .229423,
3     $ .373270, .372207, 1.233335, .015500, .015511, .015612,
3     $ .015530, .015664, .015712, .015225, .015922, .015667,
3     $ .014433, .013710, .016373, .025355, .044665, .075104,
3     $ .125303, .212940, .354137, .550742, 1.310334, .013650,
3     $ .013679, .013633, .013633, .013724, .013753, .013864,
3     $ .013927, .013672, .012707, .012253, .015231, .023765,
3     $ .040162, .067941, .113840, .184330, .323095, .619698,
3     $ 1.279343, .011700, .011703, .011710, .011724, .011750,
3     $ .011727, .011657, .011912, .011535, .010916, .010690,
3     $ .013379, .020222, .035320, .053684, .100759, .175310,
3     $ .357419, .575927, 1.237823, .009750, .009762, .009760,
3     $ .009774, .009703, .009325, .009334, .008921, .009733,
3     $ .009124, .006051, .011433, .017321, .030237, .051532,
3     $ .087230, .154494, .263354, .520973, 1.186633/
3C
3      DATA T234/ .007800, .007813, .007803, .007821, .007841,
3     $ .007861, .007918, .007934, .007731, .007324, .007346,
3     $ .009372, .014595, .024893, .042799, .072446, .132593,
3     $ .234244, .451644, 1.128342, .005350, .005352, .005855,
3     $ .005861, .005374, .005606, .005931, .005942, .005837,
3     $ .005514, .005534, .007204, .011115, .018326, .033492,
3     $ .055065, .103904, .180026, .355123, 1.054663, .003900,
3     $ .003301, .003303, .003303, .003916, .003931, .003956,
3     $ .003351, .003300, .003677, .003737, .005043, .007621,
3     $ .013592, .024706, .033451, .023937, .133232, .260169,
3     $ .537379, .001550, .001950, .001952, .001554, .001958,
3     $ .001937, .001930, .001530, .001568, .001343, .001915,
3     $ .002267, .003301, .007356, .015751, .018233, .063702,
3     $ .134751, .131375, .227732, .000100, .000000, .000000,
3     $ .000001, .000000, .000002, .000004, -.000004, .000045,
3     $ .000007, .000013, .000779, -.000331, .001493, .007419,
3     $ -.005456, .040942, .033117, -.033354, .657033/
3C
3      DATA T331/ 1.000000, 1.004344, .973723, .533073, .393979,
3     $ .443344, .433333, .537143, .592234, .643030, .693815,
3     $ .743307, .794079, .842322, .892325, .943751, .979320,
3     $ 1.070304, 1.033100, .199533, .017750, .321153, .891669,
3     $ .374650, .403115, .453123, .494057, .541693, .594064,
3     $ .645304, .695232, .745000, .726137, .844230, .895557,
3     $ .946910, .933165, 1.055736, 1.077797, .659473, .875323,
3     $ .579023, .334346, .392225, .415260, .465933, .501270,
3     $ .716054, .593096, .643030, .605123, .744933, .794995,
3     $ .844079, .894723, .944917, .920120, 1.050432, 1.099952,
3     $ .670519, .123173, .723135, .702213, .579535, .466077,
3     $ .476312, .507923, .[illegible], .223023, .647763, .693313,
3     $ .745504, .795100, .[illegible], .795924, .844332, .594775,
3     $ 1.042103, 1.034010, .[illegible], .747703, .770136, .731597,
3     $ .570470, .424714, .[illegible], .610035, .554335, .690156,
3     $ .610520, .692249, .710760, .722212, .644500, .695827,
3     $ .615127, .697979, 1.[illegible], 1.040310, 1.120933/
3C
```

```
3      DATA T382/ .728321, .785022, .835409, .863257, .890063,
3     $  .939240, .913241, .957335, .982179, .949372, .997281,
3     $  .745025, .795045, .844315, .834459, .944033, .999757,
3     $ 1.038463, 1.069930, 1.279303, .978523, .976251, .942365,
3     $  .949059, .992393, .935812, .924344, .961502, .904190,
3     $  .951863, .998541, .948743, .939660, .944727, .995743,
3     $  .945915, 1.001241, 1.042705, 1.036208, 1.394511, .928710,
3     $  .926107, .900373, .938070, .897445, .901934, .928770,
3     $  .934537, .906101, .952320, .933397, .948944, .996444,
3     $  .944635, .995323, .945913, 1.002076, 1.045757, 1.120127,
3     $ 1.474952, .978899, .976160, .960576, .923659, .902732,
3     $  .908034, .932216, .965319, .907912, .952459, .999025,
3     $  .946817, .995277, .944351, .994030, .944845, 1.002420,
3     $ 1.048169, 1.140332, 1.525152, .929037, .928689, .921735,
3     $  .906573, .900610, .912908, .937772, .970767, .909672,
3     $  .955227, .700393, .747743, .797290, .844809, .895678,
3     $  .946744, 1.002657, 1.054393, 1.158573, 1.548161/
3C
3      DATA T383/ .479250, .479565, .482538, .492438, .502985,
3     $  .917597, .940877, .972832, .911282, .955203, .700476,
3     $  .747666, .796353, .844519, .894575, .945598, 1.002315,
3     $ 1.056993, 1.169097, 1.548305, .429501, .430858, .443190,
3     $  .477478, .504019, .522104, .544280, .575149, .912788,
3     $  .955817, .700839, .747820, .796159, .844398, .894143,
3     $  .945031, 1.001697, 1.059347, 1.174918, 1.528924, .379786,
3     $  .382393, .403316, .461180, .502948, .529040, .548526,
3     $  .578136, .914192, .957744, .701799, .748449, .797444,
3     $  .844628, .895058, .945775, 1.000858, 1.062770, 1.176827,
3     $ 1.493295, .330180, .332059, .351638, .448532, .907531,
3     $  .930526, .950570, .979407, .915425, .957179, .701598,
3     $  .748173, .796107, .844192, .893519, .943845, .999454,
3     $ 1.061465, 1.172130, 1.444295, .280770, .281354, .318121,
3     $  .433451, .908280, .934308, .954118, .981853, .916550,
3     $  .958716, .702357, .748573, .797130, .844327, .894154,
3     $  .944150, .997884, 1.062955, 1.166017, 1.384541/
3C
3      DATA T384/ .231759, .228998, .271615, .421767, .914185,
3     $  .938402, .956710, .933592, .917504, .959321, .702674,
3     $  .748829, .797220, .844216, .893893, .943491, .995867,
3     $ 1.061550, 1.156720, 1.316522, .183565, .174313, .220851,
3     $  .414915, .927255, .942941, .957938, .984305, .918252,
3     $  .958471, .702303, .748453, .795813, .843722, .892206,
3     $  .941339, .993342, 1.057515, 1.145287, 1.242253, .136648,
3     $  .117594, .164840, .403226, .932188, .945155, .960966,
3     $  .986512, .918827, .960350, .703191, .749082, .797521,
3     $  .843939, .893412, .942487, .990676, 1.058095, 1.137732,
3     $ 1.163707, .091936, .057597, .101374, .403775, .954985,
3     $  .948491, .962332, .987606, .919090, .959955, .703012,
3     $  .748843, .796779, .843544, .892211, .941399, .987375,
3     $ 1.053941, 1.130518, 1.082479, .050736, -.006350, .027902,
3     $  .411528, .933934, .950513, .963540, .988716, .918951,
3     $  .959175, .702642, .743417, .795696, .843219, .890529,
3     $  .940470, .983578, 1.043731, 1.128374, 1.000000/
3C
3      DATA T431/ .004630, .004630, .004630, .004631, .004629,
3     $  .004635, .004642, .004620, .004754, .004549, .004666,
3     $  .009769, .009712, .009700, .025193, -.010492, .118104,
3     $  .104731, -.069799, 2.330975, .004385, .004397, .004391,
3     $  .004395, .004401, .004404, .004435, .004478, .004638,
3     $  .004920, .005663, .003038, .011695, .023434, .055158,
3     $  .109370, .283339, .630538, 1.553083, 4.283993, .004143,
3     $  .004147, .004145, .004149, .004155, .004172, .004212,
3     $  .004293, .004563, .005031, .006337, .010163, .016284,
3     $  .037349, .034759, .175514, .505514, 1.025011, 2.522259,
3     $ 8.103794, .003900, .003905, .003903, .003903, .003918,
3     $  .003940, .003934, .004119, .004477, .005130, .007064,
3     $  .012042, .020933, .050339, .112552, .245553, .698353,
3     $ 1.395242, 3.548549, 11.102243, .003655, .003661, .003661,
3     $  .003663, .003681, .003707, .003775, .003937, .004378,
3     $  .005223, .007679, .013759, .023537, .032183, .139340,
3     $  .316031, .835437, 1.723185, 4.539099, 13.337451/
3C
3      DATA T432/ .003413, .003414, .003415, .003422, .003435,
3     $  .003472, .003540, .003742, .004235, .005273, .008188,
3     $  .015374, .029597, .072603, .165031, .377910, 1.014259,
3     $ 2.157751, 5.455319, 15.223331, .003169, .003176, .003175,
```

```
3     $  .003183,  .003199,  .003237,  .003327,  .003545,  .004136,
3     $  .005283,  .008585,  .016550,  .032837,  .081578,  .185377,
3     $  .430161, 1.137276, 2.467190, 5.235548,16.630641,  .002926,
3     $  .002931,  .002931,  .002939,  .002957,  .002999,  .003097,
3     $  .003337,  .003985,  .005245,  .008363,  .017708,  .035597,
3     $  .088740,  .202862,  .473275, 1.235212, 2.734299, 6.861943,
3     $17.590091,  .002682,  .002682,  .002683,  .002685,  .002694,  .002711,
3     $  .002760,  .002861,  .003118,  .003811,  .005160,  .009009,
3     $  .018462,  .037624,  .094030,  .216552,  .506057, 1.306782,
3     $ 2.945252, 7.332422,18.188644,  .002439,  .002445,  .002444,
3     $  .002454,  .002473,  .002520,  .002629,  .002894,  .003612,
3     $  .005015,  .009014,  .018820,  .038742,  .097273,  .224356,
3     $  .526382, 1.350436, 3.076588, 7.631748,18.463038/
3C
3      DATA T4B3/  .002195,  .002198,  .002200,  .002209,  .002227,
3     $  .002277,  .002385,  .002556,  .003387,  .004813,  .008874,
3     $  .018838,  .039129,  .098467,  .227774,  .535593, 1.366356,
3     $ 3.137190, 7.762745,18.464763,  .001951,  .001953,  .001956,
3     $  .001964,  .001982,  .002033,  .002140,  .002409,  .003136,
3     $  .004556,  .008589,  .018491,  .038729,  .097578,  .226327,
3     $  .533144, 1.354719, 3.123691, 7.722816,18.233629,  .001708,
3     $  .001712,  .001713,  .001721,  .001740,  .001787,  .001893,
3     $  .002154,  .002858,  .004246,  .008161,  .017774,  .037522,
3     $  .094614,  .219859,  .518734, 1.316257, 3.033276, 7.508407,
3     $17.808733,  .001464,  .001465,  .001468,  .001476,  .001492,
3     $  .001539,  .001638,  .001885,  .002555,  .003865,  .007583,
3     $  .016686,  .035398,  .089637,  .207883,  .490979, 1.253101,
3     $ 2.853377, 7.103634,17.224007,  .001220,  .001222,  .001224,
3     $  .001231,  .001247,  .001290,  .001382,  .001610,  .002229,
3     $  .003448,  .006875,  .015346,  .032579,  .082805,  .192798,
3     $  .451440, 1.167923, 2.611325, 6.514965,16.511740/
3C
3      DATA T4B4/  .000976,  .000978,  .000980,  .000985,  .001000,
3     $  .001039,  .001122,  .001323,  .001885,  .002963,  .006020,
3     $  .013756,  .028730,  .074168,  .173415,  .395494, 1.064147,
3     $ 2.289928, 5.712785,15.700562,  .000732,  .000733,  .000735,
3     $  .000741,  .000751,  .000785,  .000856,  .001022,  .001532,
3     $  .002398,  .004994,  .012100,  .023562,  .063768,  .151100,
3     $  .322304,  .946691, 1.894989, 4.664829,14.814844,  .000489,
3     $  .000489,  .000490,  .000496,  .000502,  .000533,  .000591,
3     $  .000705,  .001181,  .001771,  .003784,  .010664,  .017029,
3     $  .051712,  .129230,  .226529,  .820912, 1.445765, 3.344271,
3     $13.878120,  .000245,  .000244,  .000245,  .000251,  .000251,
3     $  .000280,  .000324,  .000357,  .000861,  .001025,  .002256,
3     $  .009950,  .008112,  .037553,  .111326,  .099028,  .693067,
3     $  .976338, 1.695291,12.909414,  .000001,  .000000,  .000001,
3     $  .000008, -.000005,  .000027,  .000060, -.000050,  .000622,
3     $  .000096,  .000182,  .010843, -.004507,  .020433,  .103236,
3     $ -.075919,  .569691,  .502551, -.373584,11.925789/
3C
3C     INTERPOLATE NUMERICAL SOLUTION BY QUADRATICS
3C
3      CALL QUADRD(X,Y,TABLE,GRIDX,GRIDY,NGRID,NGRID,NGRDD,NGRDD,
3     $            DERVSL)
3C
3      TRUE = DERVSL(G)
3C
3      RETURN
3      END
3      FUNCTION F(Y)
3      DATA BREAK,PI2/&A,1.570796327/
3      F = EXP(PI2*(BREAK-Y))*SIN(PI2*Y)/&A**3
3      RETURN
3      END
3      FUNCTION A(X)
3      DATA BREAK/&A/
3      A = 1.
3      IF (X .GE. BREAK) A=0.
3      RETURN
3      END
3      FUNCTION B(X)
3      DATA BREAK/&A/
3      B = 0.
3      IF (X .GE. BREAK) B=1.
3      RETURN
3      END
```

```
3     FUNCTION C(X)
3     DATA BREAK,KASE/&A,&C/
3     C = 1.
3     IF (KASE .EQ. 2 .AND. X .GE. BREAK) C=0.
3     RETURN
3     END
3     FUNCTION D(X)
3     DATA BREAK,KASE/&A,&C/
3     D = 0.
3     IF (KASE .EQ. 2 .AND. X .GE. BREAK) D=1.
3     RETURN
3     END
3     FUNCTION G(X)
3     DATA BREAK,DECAY0/&A,2./
3     G = 1./&A**3
3     IF (X .GE. BREAK) G=G*EXP(DECAY0*(BREAK-X))
3     RETURN
3     END
3     FUNCTION H(X)
3     DATA BREAK,KASE,DECAY1/&A,&C,&B/
3     H = 0.
3     IF (KASE .EQ. 1) RETURN
3     IF (X .GE. BREAK) H=EXP(DECAY1*(BREAK-X))/&A**3
3     RETURN
3     END
```

```
'EOR
*************
* MACRO  SS *
*************
*          2000200202000
1         TWO DIMENSIONS $ HOMOGENEOUS
1         UXX$ + C(X)UYY$ + D(X)UX$ = 0.
2         DIRICHLET
2         X=0. ,              U=TRUE(X,Y)
2         X=1. ,              U=TRUE(X,Y)
2         Y=0. ,              U=TRUE(X,Y)
2         Y=6.28318530718 ,   U=TRUE(X,Y)
3     FUNCTION TRUE(X,Y)
3     DIMENSION ALPHA(8), W(4), Z(4)
3     DATA ALPHA/1., .5, .25, .16666666667, -.1, -.06666666667,
3    $    .03333333333, -.02/
3     DATA W/0.34785485, .65214515, .652515, .34785485/
3     DATA Z/-.86113631, -0.33998104, .33998104, .86113631/
3     IF (&A .EQ. 3) GO TO 10
3     W(1) = 2.0
3     Z(1) = 0.0
3     GO TO 20
3  10 CONTINUE
3     W(1) =  0.34785485
3     Z(1) = -0.86113631
3  20 CONTINUE
3     TRUE = 0.0
3     DO 30 I=1,&A+1
3        TRUE = TRUE + W(I)*(EXP(-Z(I)*X*SIN(Y))*
3    $                 COS(Z(I)*X*COS(Y))+EXP(-Z(I)*X*COS(Y))*
3    $                 COS(Z(I)*X*SIN(Y)))
3  30 CONTINUE
3     DO 40 I=1,&B
3        TRUE = TRUE + ALPHA(I)*X**(I+I)*COS((I+I)*Y)
3  40 CONTINUE
3     RETURN
3     END
3     FUNCTION C(X)
3     C = 0.
3     IF (X .NE. 0.) C = 1./X**2
3     RETURN
3     END
3     FUNCTION D(X)
3     D = 0.
3     IF (X .NE. 0.) D = 1./X
3     RETURN
3     END
```

```
$
'EOR
```

```
**************************************************************************
*                                                                        *
* - - - - - - - -  - - -  - - - - - - - - - -  - - - - - -  - - - -  *
* E L L P A C K  P D E  P O P U L A T I O N  M O D U L E  D A T A  *
* - - - - - - - -  - - -  - - - - - - - - - -  - - - - - -  - - - -  *
*                                                                        *
**************************************************************************
```

MODATA

MODATA CONTAINS THE INFORMATION NEEDED TO DECODE ENCODED ELLPACK PROGRAMS AND CHECK COMPATIBILITY.

LINE 1 HAS THE NUMBER OF MODULES (NRMODS) IN I3 FORMAT. NEXT FOLLOWS NRMODS PAIRS OF LINES. THE FIRST OF EACH CONTAINS A UNIQUE INTEGER IN THE RANGE 1,...,NRMODS IN I3 FORMAT AND AN ELLPACK MODULE NAME STARTING IN COLUMN 6. THESE GIVE THE CORRESPONDENCES BETWEEN MODULE NUMBERS USED IN ENCODED PROGRAMS AND THE NAMES OF MODULES TO BE USED IN THE GENERATED ELLPACK PROGRAM. THE SECOND LINE OF THE PAIR CONTAINS A LIST OF INTEGERS IN 4X,30I3 FORMAT OF THE MODULE NUMBERS THAT MAY IMMEDIATELY FOLLOW THIS MODULE IN ELLPACK PROGRAMS. AFTER THIS SET OF LINES THERE IS ONE LINE CONTAINING A SINGLE INTEGER IN I3 FORMAT GIVING THE NUMBER OF DISCRETIZATION MODULES (NRDIS). THIS IS FOLLOWED BY NRDIS LINES EACH CONTAINING A MODULE NUMBER IN I3 FORMAT AND 15 DIGITS STARTING IN COLUMN 5 GIVING MODULE COMPATIBILITY INFORMATION (SEE ROUTINES GENPGN AND COMPAT).

RELATED FILES: GENPGM, EQNFIL, MACFIL, OPTFIL, GRDFIL AND OUTFIL

```
39
01  5-POINT STAR
    14 15 16 17 32
02  7-POINT 3D
    14 15 16 17
03  P3-C1 COLLOCATION
    14
04  P3-C1 GALERKIN
    14
05  HODIE-HELMHOLTZ
    14 16 17 32
06  HODIE-ACF
    14 16 17 32
07  HODIE-ACDEF
    14 16 17 32
08  HODIE 27-POINT 3D

09  FFT 9-POINT

10  2DEPEP

11  MARCHING ALGORITHM

12  DYAKANOV-CG

13  DYAKANOV-CG4

14  NATURAL
    20 21 22 30 31 33 34 35 36 37
15  RED-BLACK
    22 30 31 33 39
16  YALE MIN DEG
    30 31 33 34 35 36 37
17  YALE RCM
    20 21 22 30 31 33 34 35 36 37
18  BAND SOLVE                      (RETIRED)

19  SYMMETRIC BAND                  (RETIRED)

20  LINPACK BAND

21  LINPACK SPD BAND

22  SPARSE GE-PIVOTING
```

```
23  SOR                                  (ITPACK 1.0 - RETIRED)
24  JACOBI SI                            (ITPACK 1.0 - RETIRED)
25  JACOBI CG                            (ITPACK 1.0 - RETIRED)
26  SYMMETRIC SOR SI                     (ITPACK 1.0 - RETIRED)
27  SYMMETRIC SOR CG                     (ITPACK 1.0 - RETIRED)
28  REDUCED SYSTEM SI                    (ITPACK 1.0 - RETIRED)
29  REDUCED SYSTEM CG                    (ITPACK 1.0 - RETIRED)
30  YALE SPARSE
31  YALE ENVELOPE
32  NESTED DISSECTION
    30 31 33 34 35 36 37
33  SOR
34  JACOBI SI
35  JACOBI CG
36  SYMMETRIC SOR SI
37  SYMMETRIC SOR CG
38  REDUCED SYSTEM SI
39  REDUCED SYSTEM CG

13
01  201111110111112
02  021101210111111
03  201111011111111
04  201101210200212
05  201101010200122
06  201101010200122
07  201111010200122
08  022102010200222
09  201112110200122
10  201101210111112
11  201101210111112
12  201101210111112
13  201101210111112
'EOR
```

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*****************************************************************************
*                                                                           *
* - - - - - - - -  - - -  - - - - - - - - - -  - - - - - - -  - - - - -  *
* E L L P A C K   P D E   P O P U L A T I O N   O P T I O N S   F I L E *
* - - - - - - - -  - - -  - - - - - - - - - -  - - - - - - -  - - - - -  *
*                                                                           *
*****************************************************************************
```

OPTFIL

OPTFIL CONTAINS INFORMATION WHICH MAY BE USED TO GENERATE THE OPTIONS SEGMENT OF AN ELLPACK PROGRAM.

OPTFIL IS DIVIDED UP INTO RECORDS WHICH ARE NUMBERED 0, 1, 2,... ETC. THE END-OF-RECORD IS DESIGNATED BY $EOR ('EOR ON NON-CDC INSTALLATIONS).

RECORD 0 CONTAINS A DESCRIPTION OF THE PURPOSE AND ORGANIZATION OF OPTFIL. RECORDS 1, 2, 3,... HAVE THE FOLLOWING FORMAT:

LINE 1: LINE 1 CONTAINS THE RECORD NUMBER.

LINE 2: LINE 2 MUST CONTAIN THE 8 CHARACTERS OPTIONS. IN COLUMNS 1-8, FOLLOWED ON THE SAME LINE BY ALL OF THE OPTIONS SELECTED.

RELATED FILES: GENPGM, CONFIL, MACFIL, GRDFIL, OUTFIL AND MODATA

```
---------------------------------------------------------------------------
'EOR
RECORD   1
OPTIONS.  TIME   $   MEMORY   $   LEVEL=1
---------------------------------------------------------------------------
'EOR
RECORD   2
OPTIONS.  TIME   $   MEMORY   $   LEVEL=2
---------------------------------------------------------------------------
'EOR
RECORD   3
OPTIONS.  TIME   $   MEMORY   $   LEVEL=3
---------------------------------------------------------------------------
'EOR
RECORD   4
OPTIONS.  TIME   $   MEMORY   $   LEVEL=4
---------------------------------------------------------------------------
'EOR
RECORD   5
OPTIONS.  TIME   $   MEMORY   $   LEVEL=5
---------------------------------------------------------------------------
'EOR
$
'EOR
'EOF
```

```
**********************************************************************
*                                                                    *
*   E L L P A C K   P D E   P O P U L A T I O N   G R I D   F I L E  *
*                                                                    *
**********************************************************************
```

CRDFIL

CRDFIL CONTAINS INFORMATION WHICH MAY BE USED TO GENERATE THE GRID SEGMENT OF AN ELLPACK PROGRAM.

CRDFIL IS DIVIDED UP INTO RECORDS WHICH ARE NUMBERED 0, 1, 2,... ETC. THE END-OF-RECORD IS DESIGNATED BY #EOR ('EOR ON NON-CDC INSTALLATIONS).

RECORD 0 CONTAINS A DESCRIPTION OF THE PURPOSE AND ORGANIZATION OF CRDFIL. RECORDS 1, 2, 3,... HAVE THE FOLLOWING FORMAT:

LINE 1: LINE 1 CONTAINS THE RECORD NUMBER.

REMAINING LINES: THE REMAINING LINES OF THE RECORD CONTAIN THE GRID SEGMENT EXACTLY AS IT WILL APPEAR IN THE GENERATED ELLPACK PROGRAM. TO SPECIFY AN ELLPACK CONTINUATION LINE, TYPE A '.' (DOT) IN COLUMN 2. THE INFORMATION OF THIS RECORD IS COPIED DIRECTLY INTO THE GRID SEGMENT OF THE GENERATED ELLPACK PROGRAM. FOR PORTABILITY PURPOSES, THE END-OF-RECORD IS DETECTED BY THE PRESENCE OF A '-' (DASH) IN COLUMN 1.

RELATED FILES: GENPGM, EQNFIL, MACFIL, OPTFIL, OUTFIL AND MODATA

```
----------------------------------------------------------------------
'EOR
RECORD   1
         UNIFORM X = 5   $   UNIFORM Y = 5
----------------------------------------------------------------------
'EOR
RECORD   2
         UNIFORM X = 8   $   UNIFORM Y = 8
----------------------------------------------------------------------
'EOR
RECORD   3
         UNIFORM X=5 $ NGRIDY=12, 0.0, 0.123, 0.24633, 0.479532,
 . 0.6978401, 0.80823, 1.0, 1.35794, 1.864323, 2.09094,
 . 2.49785, 3.0
----------------------------------------------------------------------
'EOR
$
'EOR
'EOF
```

```
**************************************************************************
*                                                                        *
* - - - - - - - -  - - -  - - - - - - - - - -  - - - - - -  - - - -  *
* E L L P A C K   P D E   P O P U L A T I O N   O U T P U T   F I L E *
* - - - - - - - -  - - -  - - - - - - - - - -  - - - - - -  - - - -  *
*                                                                        *
**************************************************************************

   OUTFIL
   ------

      OUTFIL CONTAINS INFORMATION WHICH MAY BE USED TO GENERATE THE
   OUTPUT SEGMENT OF AN ELLPACK PROGRAM.

      OUTFIL IS DIVIDED UP INTO RECORDS WHICH ARE NUMBERED 0, 1, 2,...
   ETC.  THE END-OF-RECORD IS DESIGNATED BY #EOR ('EOR ON NON-CDC
   INSTALLATIONS).

      RECORD 0 CONTAINS A DESCRIPTION OF THE PURPOSE AND ORGANIZATION
   OF OUTFIL.  RECORDS 1, 2, 3,... HAVE THE FOLLOWING FORMAT:

      LINE 1:  LINE 1 CONTAINS THE RECORD NUMBER.

      REMAINING LINES:  THE REMAINING LINES OF THE RECORD CONTAIN THE
      OUTPUT SEGMENT EXACTLY AS IT WILL APPEAR IN THE GENERATED ELL-
      PACK PROGRAM.  TO SPECIFY AN ELLPACK CONTINUATION LINE, TYPE A
      '.' (DOT) IN COLUMN 2.  THE INFORMATION OF THIS RECORD IS COPIED
      DIRECTLY INTO THE OUTPUT SEGMENT OF THE GENERATED ELLPACK
      PROGRAM.  FOR PORTABILITY PURPOSES, THE END-OF-RECORD IS
      DETECTED BY THE PRESENCE OF A '-' (DASH) IN COLUMN 1.

   RELATED FILES:  GENPGM, EQNFIL, MACFIL, OPTFIL, GRDFIL AND MODATA

------------------------------------------------------------------------
'EOR
RECORD   1
            TABLE-SOLUTION  $  MAX-SOLUTION  $  MAX-ERROR
------------------------------------------------------------------------
'EOR
RECORD   2
            TABLE-SOLUTION  $  PLOT-SOLUTION
------------------------------------------------------------------------
'EOR
RECORD   3
            PLOT-TRUE
------------------------------------------------------------------------
'EOR
RECORD   4
            TABLE-ERROR   $   MAX-ERROR   $   MAX-SOLUTION
------------------------------------------------------------------------
'EOR
RECORD   5
            TABLE-TRUE   $   TABLE-SOLUTION   $   TABLE-ERROR
------------------------------------------------------------------------
'EOR
RECORD   6
            TABLE-TRUE $ TABLE-SOLUTION $ TABLE-ERROR
            PLOT-TRUE  $ PLOT-SOLUTION  $ PLOT-ERROR
------------------------------------------------------------------------
'EOR
RECORD   7
            TABLE-ERROR $ MAX-ERROR
            PLOT-TRUE $ PLOT-SOLUTION $ PLOT-ERROR
------------------------------------------------------------------------
'EOR
$
'EOR
'EOF
```

```
      SUBROUTINE TEST(LOOP)                                                 TEST
C                                                                           TEST
C  TEST IS CALLED AT THE END OF THE STANDARD MODULE SEQUENCE IN             TEST
C  THE PDE PERFORMANCE EVALUATION TESTING.  IT COMPUTES VARIOUS             TEST
C  PERFORMANCE MEASURES ABOUT THE RUN AND WRITES IT ONTO TAPE4.             TEST
C                                                                           TEST
C  THIS ROUTINE IS BASED UPON THE SEPT 1978 VERSION OF ELLPACK 77.          TEST
C                                                                           TEST
C                                                                           ELDECL
C  ELLPACK 77 INTERFACE                                                     ELDECL
C                                                                           ELDECL
      LOGICAL DIM2,DIM3,POISON,LAPLAC,CONSTC,SELFAD,CROSST,DIRICH,          ELDECL
     $        NEUMAN,MIXED,UNIFRM,DEBUG,TIMER,HOMOEQ,HOMOBC,SYMMET,         ELDECL
     $        FATAL,CLOCKW,RECTAN                                           ELDECL
      REAL             AX,BX,AY,BY,AZ,BZ,HX,HY,HZ,CUXX,CUXY,CUYY,          ELDECL
     $        CUX,CUY,CU,CUXZ,CUYZ,CUZZ,CUZ,EPSGRD                          ELDECL
      INTEGER IROT(6),HORZ,VERT,BOTH,INTER,STAR,ONE,MINUS,XXX,EXTER,        ELDECL
     $        PERIOD,CORNER                                                 ELDECL
C                                                                           ELDECL
      COMMON / PROBL  / DIM2,DIM3,POISON,LAPLAC,CONSTC,SELFAD,HOMOEQ,       ELDECL
     $                  CROSST,HOMOBC,DIRICH,NEUMAN,MIXED,UNIFRM            ELDECL
      COMMON / PROBR  / AX,BX,AY,BY,AZ,BZ,HX,HY,HZ                         ELDECL
      COMMON / PROBI  / NGRIDX,NGRIDY,NGRIDZ                               ELDECL
      COMMON / CPDE   / CUXX,CUXY,CUYY,CUX,CUY,CU,CUXZ,CUYZ,CUZZ,CUZ       ELDECL
      COMMON / CONTRL / DEBUG,TIMER,SYMMET,FATAL,RECTAN                     ELDECL
      COMMON / INTEGS / NUMBEQ,NUMCOE,NROW,NCOL,NBAND,IROT,LEVEL,           ELDECL
     $                  INITL,INDIS,INSOL,MINPUT,                          ELDECL
     $                  MOUTPT,MEMORY,ININD,NGRDXZ,NGRDYZ,                 ELDECL
     $                  NGRDZZ,MXNEQZ,MXNCOZ,NROWDZ,NCOLDZ                 ELDECL
      COMMON / REALS  / ERRMAX,SOLMAX,TRUMAX,RESMAX,TIMES(1)                ELDECL
      COMMON / BNDRY  / IPIECE,NBOUND,NBNDPT,CLOCKW                         ELDECL
      COMMON / SYMCON / HORZ,VERT,BOTH,INTER,STAR,ONE,BLANK,MINUS,          ELDECL
     $                  XXX,EXTER,PERIOD,CORNER                             ELDECL
      COMMON / NUMCON / EPSGRD                                              ELDECL
      COMMON /GRIDXZ/ GRIDX(1)                                              TEST
      COMMON /GRIDYZ/ GRIDY(1)                                              TEST
      COMMON /GRIDZZ/ GRIDZ(1)                                              TEST
      COMMON /COEFZZ/ COEF(1)                                               TEST
      COMMON /IDCOZZ/ IDCOEF(1)                                             TEST
      COMMON /TABLZZ/ TABLE(1)                                              TEST
      COMMON /UNKNZZ/ UNKNWN(1)                                             TEST
      COMMON /NDXUZZ/ NDXUNK(1)                                             TEST
      COMMON /BCTYZZ/ BCTYPE(1)                                             TEST
      COMMON /INVNZZ/ INVNDX(1)                                             TEST
      COMMON /NDXEZZ/ NDXEQ(1)                                              TEST
      COMMON /IGRIZZ/ IGRID(1)                                              TEST
C                                                                           TEST
      REAL ERRL2,RESMAX,RESL2                                               TEST
      INTEGER BCTYPE                                                        TEST
C                                                                           TEST
      DATA NRITNS /0/, INSOL/0/, NUMBEQ/0/                                  TEST
      COMMON /ITCOM1/ NRITNS                                                TEST
C       THIS IS THE NUMBER OF ITERATIONS FROM ITPACK                        TEST
C                                                                           TEST
      NGRDXZ = NGRIDX                                                       TEST
      NGRDYZ = NGRIDY                                                       TEST
      NGRDZZ = NGRIDZ                                                       TEST
C                                                                           TEST
C                                                                           TEST
C  COMPUTE L-2 DISCRETE NORM AT THE NODES                                   TEST
C                                                                           TEST
      RNODES = 1.0/FLOAT(NGRIDX*NGRIDY*NGRIDZ)                              TEST
      ERRL2 = 0.                                                            TEST
      ERR = 0.0                                                             TEST
      DO 100 IX=1,NGRIDX                                                    TEST
         DO 100 IY=1,NGRIDY                                                 TEST
            DO 100 IZ=1,NGRIDZ                                              TEST
               E = ERROR(GRIDX(IX),GRIDY(IY),GRIDZ(IZ),NGRDXZ,              TEST
     $                   NGRDYZ,NGRDZZ,GRIDX,GRIDY,GRIDZ,UNKNWN,           TEST
     $                   MXNEQZ,NDXUNK,TABLE,COEF,IDCOEF,MXNCOZ,           TEST
     $                   BCTYPE,INVNDX,NDXEQ,IGRID)                        TEST
C                                                                           TEST
               ERRL2 = ERRL2 + E*E                                          TEST
               ERR = AMAX1(ABS(E),ERR)                                      TEST
  100 CONTINUE                                                              TEST
      ERRL2 = SQRT(ERRL2)*RNODES                                            TEST
```

```
C                                                                       TEST
C COMPUTE THE ABS. MAXIMUM AND L-2 NORM OF THE RESIDUAL                 TEST
C AT THE MIDPOINTS OF EACH SUBRECTANGLE OF THE PARTITION                TEST
C                                                                       TEST
      RESMAX = -1.                                                      TEST
      RESL2 = 0.                                                        TEST
      RESMXR = 0.                                                       TEST
      ZMIDL = 0.                                                        TEST
      NZ = NGRIDZ - 1                                                   TEST
      NX = NGRIDX - 1                                                   TEST
      NY = NGRIDY - 1                                                   TEST
      IF (DIM3)  GO TO 210                                              TEST
C                                                                       TEST
C  TWO-DIMENSIONAL CASE                                                 TEST
C                                                                       TEST
      RINTVL = 1.0/FLOAT(NX*NY)                                         TEST
      DO 200 IX = 1,NX                                                  TEST
         XMIDL = (GRIDX(IX)+GRIDX(IX+1))*.5                             TEST
         DO 200 IY = 1,NY                                               TEST
            YMIDL = (GRIDY(IY)+GRIDY(IY+1))*.5                          TEST
            R = RESID(XMIDL,YMIDL,ZMIDL,NGRDX2,NGRDYZ,NGRDZZ,GRIDX,     TEST
     $                  GRIDY,GRIDZ,UNKNWN,MXNEQZ,NDXUNK,TABLE,COEF,    TEST
     $                  IDCOEF,MXNCOZ,BCTYPE,INVNDX,NDXEQ,IGRID)        TEST
            RESMAX = AMAX1(RESMAX,ABS(R))                               TEST
            RESL2 = RESL2 + R*R                                         TEST
            RHS = PDERHS(XMIDL,YMIDL)                                   TEST
            IF (RHS .NE. 0.0)  RESMXR = AMAX1(RESMXR,ABS(R/RHS))        TEST
 200  CONTINUE                                                          TEST
      RESL2 = SQRT(RESL2)*RINTVL                                        TEST
                                        GO TO 300                       TEST
C                                                                       TEST
C  THREE DIMENSIONAL CASE                                               TEST
C                                                                       TEST
  210 CONTINUE                                                          TEST
      RINTVL = 1.0/FLOAT(NX*NY*NZ)                                      TEST
      DO 250 IX = 1,NX                                                  TEST
         XMIDL = (GRIDX(IX)+GRIDX(IX+1))*.5                             TEST
         DO 250 IY = 1,NY                                               TEST
            YMIDL = (GRIDY(IY)+GRIDY(IY+1))*.5                          TEST
            DO 250 IZ = 1,NZ                                            TEST
               ZMIDL = (GRIDZ(IZ)+GRIDZ(IZ+1))*.5                       TEST
            R = RESID(XMIDL,YMIDL,ZMIDL,NGRDX2,NGRDYZ,NGRDZZ,GRIDX,     TEST
     $                  GRIDY,GRIDZ,UNKNWN,MXNEQZ,NDXUNK,TABLE,COEF,    TEST
     $                  IDCOEF,MXNCOZ,BCTYPE,INVNDX,NDXEQ,IGRID)        TEST
            RESMAX = AMAX1(RESMAX,ABS(R))                               TEST
            RESL2 = RESL2 + R*R                                         TEST
            RHS = PDERHS(XMIDL,YMIDL,ZMIDL)                             TEST
            IF (RHS .NE. 0.0)  RESMXR = AMAX1(RESMXR,ABS(R/RHS))        TEST
 250  CONTINUE                                                          TEST
      RESL2 = SQRT(RESL2)*RINTVL                                        TEST
C                                                                       TEST
C COMPUTE THE TOTAL EXECUTION TIME                                      TEST
C                                                                       TEST
 300  CONTINUE                                                          TEST
C                                                                       TEST
C     FIRST FIND NUMBER OF MODULES IN EXECUTION SEQUENCE                TEST
      GO TO (303,303,303,301,303,303,301,301,301,303,301,303,303,       TEST
     $       301), INDIS                                                TEST
  301    CONTINUE                                                       TEST
         NRMODL = 1                                                     TEST
         GO TO 320                                                      TEST
  303    CONTINUE                                                       TEST
         NRMODL = 3                                                     TEST
  320 CONTINUE                                                          TEST
C                                                                       TEST
C     ADD TIME TO REFORMAT LINEAR SYSTEM (EXCEPT YALE SPARSE)           TEST
      IF ((INSOL .NE. 15) .AND. (NRMODL .EQ. 3))                        TEST
     $       TIMES(3) = TIMES(3) + TIMES(4)                             TEST
C                                                                       TEST
C     NOW COMPUTE THE TOTAL TIME                                        TEST
      TLTIME = 0.0                                                      TEST
      DO 325 I=1,NRMODL                                                 TEST
         TLTIME = TLTIME + TIMES(I)                                     TEST
  325 CONTINUE                                                          TEST
C                                                                       TEST
C  FIND MAX DISTANCE BETWEEN ANY TWO GRID LINES                         TEST
```

```
C                                                                       TEST
      IF (UNIFRM)  GO TO 370                                            TEST
C                                                                       TEST
C        CASE OF NON-UNIFORM GRID                                       TEST
         HMAX = 0.0                                                     TEST
         DO 330 I=1,NX                                                  TEST
            DX = GRIDX(I+1)-GRIDX(I)                                    TEST
            HMAX = AMAX1(DX,HMAX)                                       TEST
  330    CONTINUE                                                       TEST
         DO 340 I=1,NY                                                  TEST
            DY = GRIDY(I+1)-GRIDY(I)                                    TEST
            HMAX = AMAX1(DY,HMAX)                                       TEST
  340    CONTINUE                                                       TEST
         IF (DIM2)  GO TO 360                                           TEST
            DO 350 I=1,NZ                                               TEST
               DZ = GRIDZ(I+1)-GRIDZ(I)                                 TEST
               HMAX = AMAX1(DZ,HMAX)                                    TEST
  350       CONTINUE                                                    TEST
  360    CONTINUE                                                       TEST
         GO TO 380                                                      TEST
C                                                                       TEST
C        CASE OF UNIFORM GRID                                           TEST
  370    CONTINUE                                                       TEST
         HMAX = AMAX1(HX,HY)                                            TEST
         IF (DIM3)  HMAX = AMAX1(HZ,HMAX)                               TEST
  380 CONTINUE                                                          TEST
C                                                                       TEST
C  WRITE SUMMARY OF ELLPACK RUN ON SAVE FILE                            TEST
C                                                                       TEST
      WRITE(4,1000) NGRIDX,NGRIDY,HMAX,NUMBEQ,ERR,ERRMAX,ERRL2,         TEST
     $              RESMAX,RESMXR,RESL2,SOLMAX,NRITNS,MEMORY,TLTIME,    TEST
     $              (TIMES(I),I=1,NRMODL)                               TEST
 1000 FORMAT(1X,2I4,1X,E10.2,1X,I5,2X,7E9.2,1X,I3,1X,I5,1X,4F6.2)       TEST
C                                                                       TEST
      RETURN                                                            TEST
      END                                                               TEST
'EOR
```

```
      REAL              FUNCTION  QUADR(X,AUX,VALUX,N)                  QUADR
C                                                                         QUADR
C ...........................................................             QUADR
C                                                                         QUADR
C     E L L P A C K    7 8    O U T P U T    M O D U L E                  QUADR
C                                                                         QUADR
C     FUNCTION QUADR                                                      QUADR
C                                                                         QUADR
C     PURPOSE                                                             QUADR
C         TO PERFORM 1-D EXTRAPOLATION USING N POINTS                     QUADR
C         AT THE POINT X.                                                 QUADR
C                                                                         QUADR
C     PARAMETERS                                                          QUADR
C         AUX    - VECTOR OF ARGUMENT VALUES                              QUADR
C         VALUX  - VECTOR OF FUNCTION VALUES CORRESPONDING                QUADR
C                  TO AUX.                                                QUADR
C         N      - NUMBER OF INTERPOLATION POINTS                         QUADR
C                                                                         QUADR
C     METHOD                                                              QUADR
C         DIVIDED DIFFERENCES ARE USED TO COMPUTE THE                     QUADR
C         EXTRAPOLATED VALUE.                                             QUADR
C                                                                         QUADR
C         P(X) = F1 + (X-AUX(1))*F2 + (X-AUX(1))*(X-AUX(2))*F3            QUADR
C                                                                         QUADR
C     HISTORY                                                             QUADR
C         MODIFIED BY BILL WARD, MARCH, 1979.                             QUADR
C                                                                         QUADR
C ...........................................................             QUADR
C                                                                         QUADR
      REAL              AUX(N), VALUX(N),                                 QUADR
     A                  F1, F2, F3, C1, T2                                QUADR
C                                                                         QUADR
      F1    = VALUX(1)                                                    QUADR
      F2    = (VALUX(2) - VALUX(1)) / (AUX(2) - AUX(1))                   QUADR
      C1    = X - AUX(1)                                                  QUADR
      QUADR = F1 + C1*F2                                                  QUADR
      IF (N .EQ. 2) GO TO 999                                             QUADR
      T2    = (VALUX(3) - VALUX(2)) / (AUX(3) - AUX(2))                   QUADR
      F3    = (T2 - F2) / (AUX(3) - AUX(1))                               QUADR
      QUADR = QUADR + C1*(X - AUX(2))*F3                                  QUADR
C                                                                         QUADR
  999 CONTINUE                                                            QUADR
      RETURN                                                              QUADR
      END                                                                 QUADR
'EOR
```

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

elliptic partial differential equations, machine readable, population of problems, linear, second order

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report contains the machine readable form of the 189 partial differential equations presented in MRC Technical Summary Report #2078 "A POPULATION OF LINEAR, SECOND ORDER, ELLIPTIC PARTIAL DIFFERENTIAL EQUATIONS ON RECTANGLES - PART 1." These are two large files: EQNFIL contains 189 entries which are either complete statements of a PDE in the ELLPACK language or a reference to an entry in MACFIL with parameter values given. MACFIL contains the 42 parameterized PDE's in a form suitable for automatically substituting in parameter values. A few other small files are given to facilitate using this problem population within the ELLPACK system.

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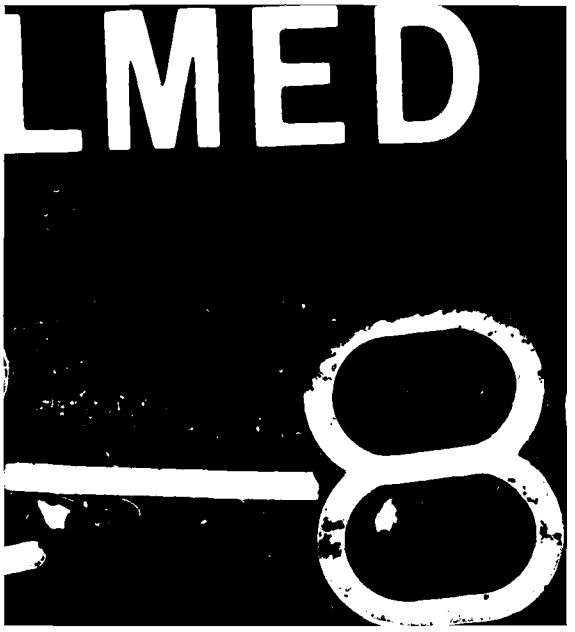
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